

INTEGRA MICROWAVE
MODEL TMF-1800 SERIES
TUNABLE MICROWAVE FILTER
(TYPE I CONTROL)
OPERATION & SERVICE MANUAL



**INTEGRA
MICROWAVE**

MP MASTER



MA32405



**INTEGRA
MICROWAVE**

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February 1984

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WARRANTY

Integra warrants this instrument to be free from defects in material and workmanship for one year from the date of delivery. Damage due to accident, abuse or improper operation, is not covered by the warranty. Removal, defacement, or alteration of any serial or inspection label, marking or seal, may void the warranty. Integra will repair or replace at its option, any components of this instrument which prove to be defective during the warranty period, provided the entire instrument is returned prepaid to Integra or its authorized service facility.

In-warranty instruments will be returned freight prepaid; out of warranty units will be returned freight collect. No other warranty other than the above warranty is expressed or implied. Integra is not liable for consequential damages.

ASSISTANCE

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1.0 GENERAL INFORMATION

1.1 Introduction

The Model TMF 1800 TUNABLE MICROWAVE FILTER provides a new microwave design, measurement and production test capability not previously available in a complete instrument. Several models are available covering the following frequency ranges:

TMF-1800A	2-26.5 GHz	3-STAGE
TMF-1800B	2-18.5 GHz	3-STAGE
TMF-1800C	2-18.5 GHz	1-STAGE
TMF-1800D1	0.5-2.0 GHz	1-STAGE
TMF-1800D2	0.5-2.0 GHz	2-STAGE
TMF-1800E	2-26.5 GHz	1-STAGE

The TMF-1800 series TUNABLE MICROWAVE FILTER is a WIDEBAND YIG FILTER which can be manually or electronically tune over the entire range specified, conveniently separating or isolating signals on the basis of frequency. The key to the TMF-1800 performance is a yttrium-iron-garnet (YIG) filter designed for maximum tuning range and minimum bandwidth. The 3 dB bandwidth is nominally 20 to 50 MHz with selectivity of 18 dB/octave for a three stage filter and 6 dB/octave for a single stage filter. The filter can be remotely located for ease of operation.

The sharp selectivity of the TMF-1800 allows signal separation and analysis over much larger dynamic ranges than previously feasible. As a tuned preselector for super-hetro-dyne spectrum analyzers, it can reduce spurious intermodulation products, images, and IF signal feed-through extending the dynamic range of conventional sweep or fixed tuned signal sources. It can extend the dynamic range of measurement setups by reducing harmonics and nonharmonically related spurious signals by 30 to 60 dB, depending on Model specified.

As a tuned postselector for microwave sweepers, synthesizers and signal generators, it can reduce harmonics and spurious output signals and extend the dynamic range of conventional swept or CW-measurements. It can reduce spurious signal outputs and additional 30 to 60 dB, improving most sweepers harmonic output levels to -55 to -70 dBc.

The TMF-1800 contain the automatic and manual controls needed for a variety of applications. For example, it can convert a comb generator output from a multi-octave signal source by selectively tuning each frequency; it can simplify intermodulation distortion measurements in amplifiers and converters; it can eliminate ambiguity in radio frequency interference (RFI) measurements. In RFI measurements, it also replaces five individual octave band filters that are required to get equal coverage.

1.2 Remote Filter Specifications

-- MODEL --

TMF-1800A

Number of Stages	3
Frequency Range	2-26.5 GHz
Bandwidth (-3 dB)	20-90 MHz
Insertion Loss (max)	8 dB
Passband Ripple and Spurious (max)	2 dB
Off Resonance Isol. (min)	60 db
Limiting Level (min)	+10 dBm
Off Resonance Spurious (min)	45 dB
Selectivity (nom)	18 dB/Oct
VSWR (typ)	2 : 1
Impedance (nom)	50 Ohms
Hysteresis (max)	24 MHz
Max. Input Power	+30 dBm
Connectors	SMA Jack (3mm)
Size (WxHxL) (Excluding RF Connectors)	2.75" x 3" x 3.75"

1.2 Remote Filter Specifications (CON'T)

-- MODEL --

	TMF-1800B	TMF-1800C
Number of Stages	3	1
Frequency Range	2-18.5 GHz	2-18.5 GHz
Bandwidth (-3 dB)	15-70 MHz	15-70 MHz
Insertion Loss (max)	8 dB	3 dB
Passband Ripple and Spurious (max)	1.5 dB	0.5 dB
Off Resonance Isol. (ORI)	70 dB	30 dB *
Limiting Level (min)	+10 dBm	+10 dBm
Off Resonance Spurious (min)	45 dB	30 dB **
Selectivity (nom)	18 dB/Oct.	6 dB/Octave
VSWR (typ)	2 : 1	2 : 1
Impedance (nom)	50 Ohms	50 Ohms
Hysteresis (max)	20 MHz	20 MHz
Max. Input Power	+30 dBm	+30 dBm
Connectors	SMA Jack (3mm)	SMA Jack (3mm)
Size (WxHxL) (Excluding RF Connectors)	2.75" x 3" x 3.25"	2.75" x 3" x 3.25"

*ORI: >-30 dB to 16 GHz; >-27 dB, 16 to 18.5 GHz

**For all frequencies 400 MHz above and below the tuned frequency.

(Tracking spurious between $F_0 \pm 400$ MHz: >-6 dB)

1.2 Remote Filter Specifications(CON'T)

-- MODEL --

	TMF-1800D1	TMF-1800D2	TMF-1800E
Number of Stages	1	2	1
Frequency Range	0.5-2.0 GHz	0.5-2.0 GHz	2-26.5 GHz
Bandwidth (-3 dB)	13-50 Mhz	15-70 MHz	15-70 MHz
Insertion Loss (max)	3 dB	6 dB	4 dB
Passband Ripple and Spurious (max)	0.75 dB	2 dB	0.5 dB
Off Resonance Isol. (ORI)	27 dB*	40 db	30 dB **
Limiting Level (min)	+10 dBm	+10 dBm	+10 dBm
Off Resonance Spurious (min)	27 dB***	27 dB***	27 dB ***
Selectivity (nom)	6 dB/Octave	12 dB/Octave	6 dB/Octave
VSWR (typ)	2 : 1	2 : 1	2 : 1
Impedance (nom)	50 Ohms	50 Ohms	50 Ohms
Hysteresis (max)	10 MHz	10 MHz	24 MHz
Max. Input Power	+30 dBm	+30 dBm	+30 dBm
Connectors	SMA Jack (3 mm)	SMA Jack (3mm)	SMA Jack (3mm)
Size (WxHxL) (Excluding RF Connectors)	2.75"x3"x3.25"	2.75"x3"x3.25"	2.75"x3"x3.25"

*ORI: >-27 dB to 8 GHz.

**ORI: >-30 dB to 12 GHz; >-24 dB, 12 to 18 GHz; >-17 dB, 18 to 26.5 GHz.

***For all Frequencies 400 MHz above and below the tuned frequency.

(Tracking Spurious between Fo $\pm$ 400 MHz : >-6 dB).

1.3 Control Unit Specifications

Frequency Accuracy	0.1% + 10MHz
Frequency Resetability (typ)	10 MHz
Operating Modes:	
CW	Frequency selected by F1, F2, or Fo, dependent on selected display F1, F2, or Fo (no sweep)
SWEEP	Sweep from F1 to F2
EXT.	External drive voltage 0 to +10V (sweeps from F1 to F2 setting, typ. 1 ms time constant)
Sweep Rate	.01 Hz, .1 Hz, 1 Hz, 10 Hz, 100 Hz (line sync)
Display Modes	
F1	Displays F1 - frequency
Fo	Displays Fo - frequency
F2	Displays F2 - frequency
Display (Models TMF-1800B,C,&D). (Resolution).....	5 digit, Light Emitting Diodes 1 MHz
(Models TMF-1800 A & E). (Resolution).....	4 digit, Light Emitting Diodes 10 MHz
Calibrate Switch	Eliminates hysteresis for highest tuning accuracy.
Horizontal Sweep Output	0 to +10 V
Analog Output	Voltage proportional to frequency 0.5 V/GHz
Temperature Range	0 to 50 degrees C
Control Unit Size (WxHxD)	8 1/2" x 5 1/4" x 17"
AC- Power	115/230 VAC, 50/60 Hz, 50 Watts max.

2.0 OPERATION

2.1 GENERAL

The TUNABLE MICROWAVE FILTER is a versatile, wide frequency range laboratory instrument that can conveniently separate or isolate signals on the basis of frequency. The control unit contains all the necessary controls and digital frequency display. The RF-Head contains a yttrium-iron-garnet (YIG) filter that can be placed remote from the control unit.

2.2 FRONT PANEL FEATURES

Figure 1 shows all the front panel controls.

- 1. AC POWER This is the AC power ON/OFF switch. When AC power is applied to the instrument and the power switch depressed, the Frequency display will be illuminated.

2. MODE (BUTTONS)

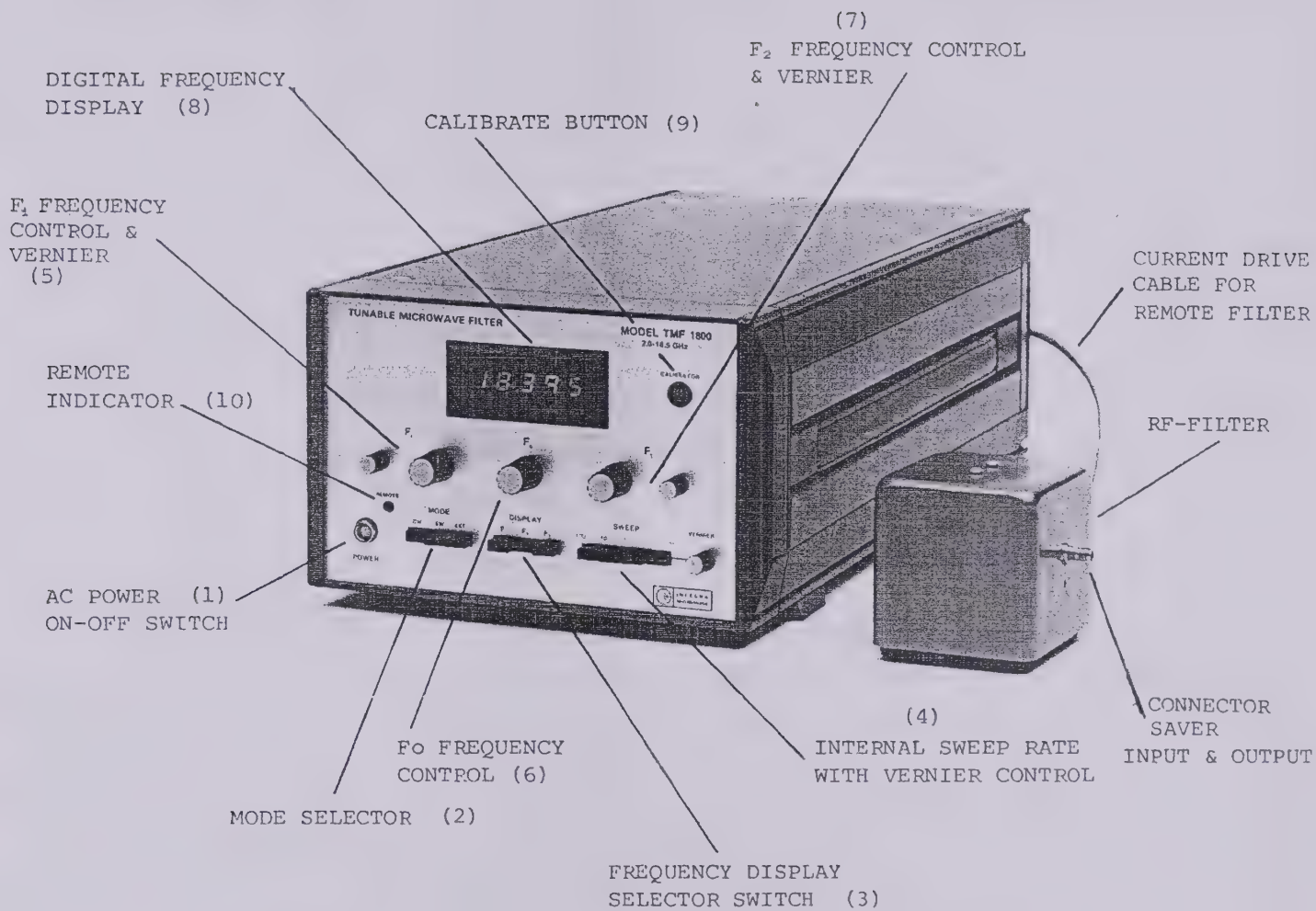
CW This selects the CW-mode, NO SWEEP is generated. When F1 - DISPLAY is selected the F1 control determines the filter frequency setting. When F2 - DISPLAY is selected the F2 control determines the filter frequency setting. When Fo-DISPLAY is selected the Fo control determines the frequency setting.

Fo always tunes between F1 and F2.

This allows presetting three (3) independent filter frequencies.

- 8 READOUT Displays frequency in GHz.
- 9 CALIBRATE This CALIBRATE button is provided to eliminate the hysteresis inherent in any YIG-filter. For highest tuning accuracy this button should be pressed momentarily after tuning of the filter to the desired frequency. When pushed this button removes the drive current to the YIG and sets the filter to "zero" frequency. It can also be used during system calibration for removing a signal calibration for removing a signal without detuning the filter.
- 10 REMOTE When in remote control operation (using IEEE-488 Bus control) the LED will be illuminated.
(Option-02)

	SWEEP		This selects the sweep mode. The filter is swept from the F1 - frequency to the F2 frequency at a rate controlled by the SWEEP selector.
	EXT		This selects the EXT. mode. A 0 to +10 V signal applied to the EXT. SWEEP input (rear panel). Tunes the filter between the F1 and F2 frequency setting.
3	DISPLAY	F1	Displays shows the F1 frequency in CW - mode and shows the start frequency in sweep-mode.
		Fo	Display shows the Fo frequency in CW mode and reads zero in Sweep-mode.
		F2	Display shows the F2 frequency in CW mode and shows the stop frequency in sweep-mode.
4	SWEEP	30	Selects a sweep rate of 30 sweeps per second.
		10	Selects a sweep rate of 10 sweeps per second.
		1	Selects a sweep rate of 1 sweep per second.
		.1	Selects a sweep rate of 1 sweep per 10 seconds.
5	F1 - Control		Controls the F1 frequency setting.
6	Fo - Control		Controls the Fo frequency setting.
7	F2 - Control		Controls the F2 frequency setting.



FRONT PANEL

FIGURE 1

2.3 REAR PANEL FEATURES

Figure 2 show all rear panel connections.

1. AC POWER INPUT This is the AC power input receptacle to the instrument.
2. FUSE This is the AC line voltage fuse holder,
For 115 VAC operation use 1A-SLOW-BLOW FUSE.
For 220 VAC operation use .5A-SLOW-BLOW FUSE.
3. FILTER This is the output connector for RF-filter power and control. Use only the control cable supplied with instruments.
will provide a filter off-set.
(See appendix "A" for operation description.)
4. ANALOG OUTPUT The analog output gives a voltage proportional to tuning frequency.(0.5 V/GHz)
5. SWEEP OUT A 0 to +10 Volt sweep voltage is available when unit is in sweep mode.
6. EXT. SWEEP An external drive voltage 0 to +10 Volts sweeps the filter from F1 to F2 setting.
(Typical time constant is 1 millisecond)
7. IEEE-488 BUS
(OPTION-02) I/O interface 24 Multi-Pin connector for IEEE-488 Bus. (See appendix "A" for description of IEEE-488 Control)
8. ADDRESS
(OPTION-02) IEEE-488 Address Switch (See appendix "A" for address description)

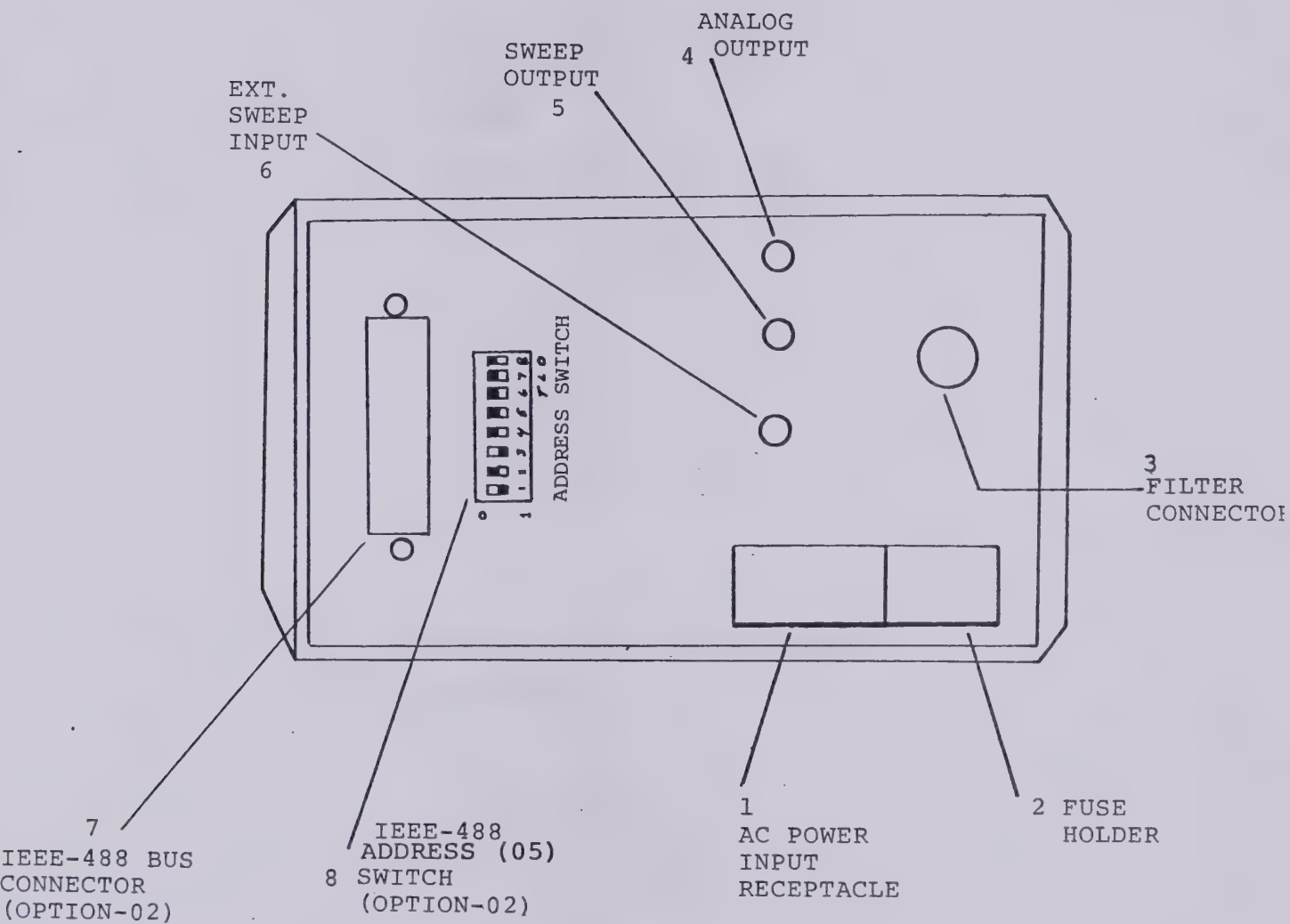


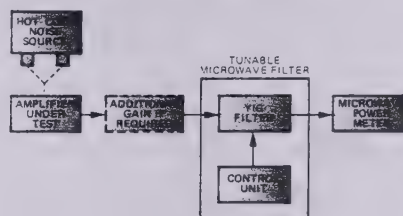
FIGURE 2

REAR PANEL TMF - 1800

2.4 TYPICAL APPLICATIONS

2.4.1 Noise Figure Measurement

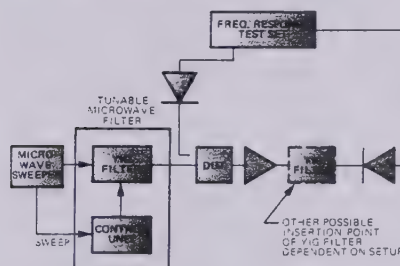
NOISE FIGURE MEASUREMENTS ON BROADBAND AMPLIFIERS



Allows you to make noise figure measurements at any frequency of interest across the amplifier's frequency range. Three frequencies can be preset with the F_1 , F_0 and F_2 frequency controls and, for example, can be set at the low end, midband and high end of the frequency band for noise figure measurements.

2.4.2 Elimination of harmonics and spurious signals for high dynamic range measurements.

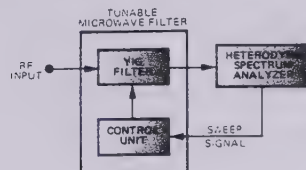
100 dB DYNAMIC RANGE MEASUREMENTS OVER MULTI- OCTAVE FREQUENCY RANGE



Prevents interference from harmonics and spurious signals which would prevent high dynamic range measurements. Allows you to make these measurements over multioctave frequency ranges since all harmonics are eliminated.

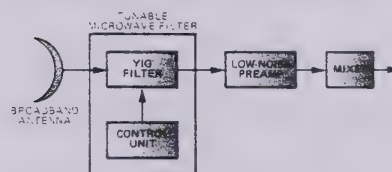
2.4.3 Preselector application for receivers and heterodyne spectrum analyzers.

TRACKING PRESELECTION FOR HETERODYNE SPECTRUM ANALYZER



Eliminates spurious intermodulation products, images and IF signal feed-through. Can extend the dynamic range by 50 to 60 dB.

PRESELECTION FOR RECEIVERS



Prevents overloading of the preamplifier by strong adjacent signals. Also prevents image responses and can be electronically tuned from a remote station.

3.0 THEORY OF OPERATION

3.1 System Operation

Figure 3 is a block diagram of the Tunable Microwave Filter. The RF-Filter head contains a bandpass yttrium-iron-garnet (YIG) Filter consisting of one, two or three stages depending upon the particular model. The Filter is driven by a YIG-Driver which converts the control voltage to a suitable current, that in turn tunes the filter. The same control voltage that is applied to the YIG-Driver is also fed to the converter circuit and is converted to drive a digital display, indicating the RF-frequency to which the filter is tuned. The Function Controller is a circuit for selecting the F1 and F2 frequencies that can be set independently of each other. A voltage (0 to +10 V) at the input of the Function Controller allows tuning between the F1 and F2 frequency setting. F1 and F2 could be considered the start/stop frequency settings of the 0 to +10 V range.

The different operating modes of the Tunable Filter are selected by applying the correct voltage to the Function Controller circuit. For F1 mode, zero voltage is applied; for F2 mode, +10 V is applied, and in the Fo mode a variable voltage (0 to +10 V) is applied.

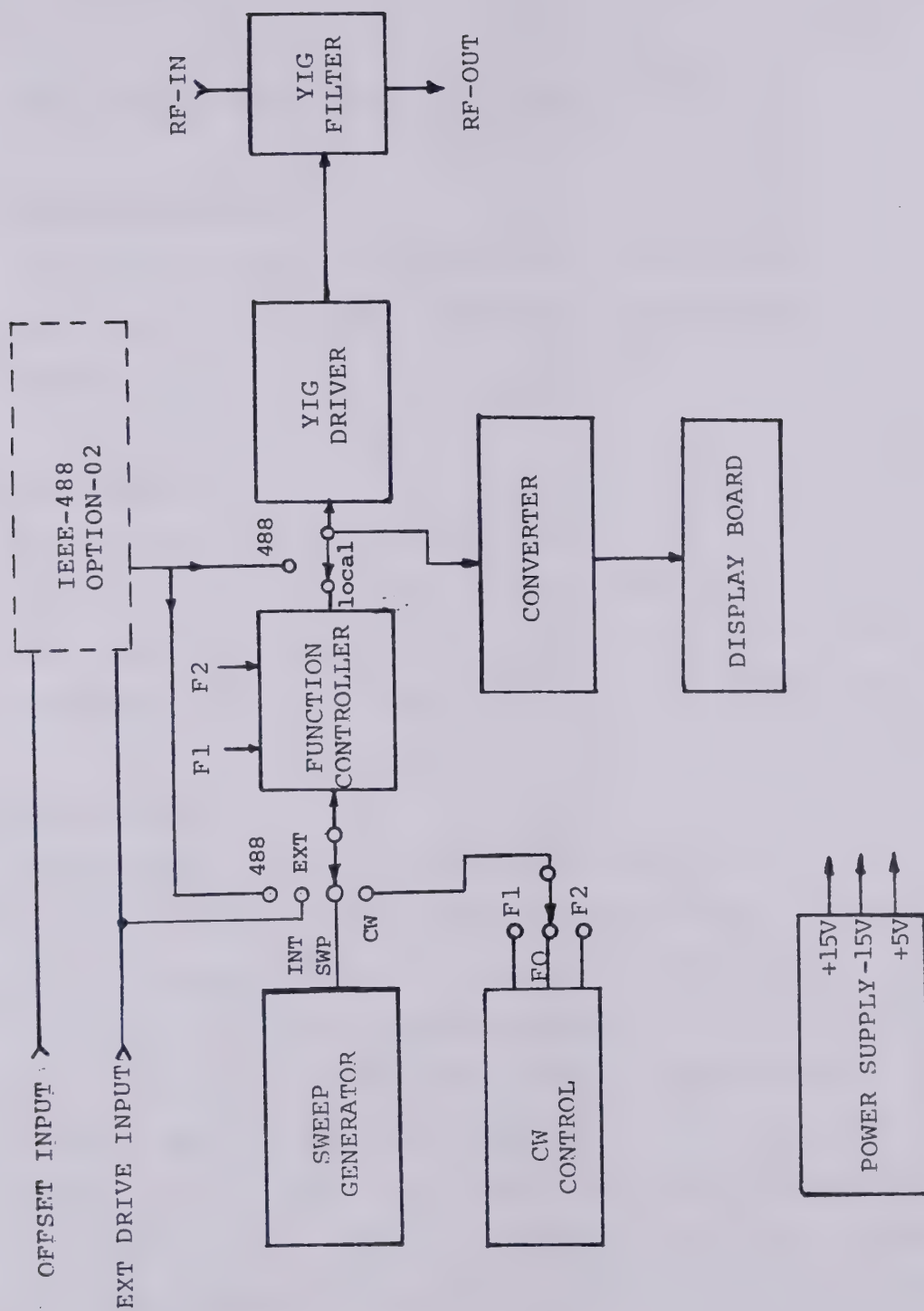


FIGURE 3
TUNABLE MICROWAVE FILTER
SYSTEM DIAGRAM

4.0 CIRCUIT DESCRIPTION (Refer to Schematic Figure 4)

4.1 REFERENCE VOLTAGE

IC4 generates a +10 volt reference voltage and is adjusted by R44.

IC5 inverts the +10 volt reference and generates -10 volt reference, adjusted by R48.

4.2 Fo ADJUSTMENT

Fo control is R37 on the front panel. IC3 is an inverting amplifier for Fo. R41 is the Fo full scale calibration, and R42 is the Fo zero calibration. The display (F1, F0 and F2) switch selects the desired display and is applied to the mode switch (CW, sweep, ect.).

4.3 SWEEP CIRCUIT

IC6 through 12 from the sweep generator circuit. IC8 is the current source which feeds the integrating capacitors C5, 6, 7, and 8. IC6 is an integrator and CR13 limits the output of IC6 to +10 volts. IC7 is the upper sweep ramp comparator and when the sweep voltage on IC6, pin 6, reaches the upper level of approximately +6 volts, IC7 switches and resets IC10. IC10 is the flip-flop that reverses the current flow in IC8. Then the integrating capacitors will start integrating down. When the voltage on IC6 pin 6 reaches -0.7 volts IC9, which is also a comparator, switches and resets IC10. The integrating process starts over again. Q2 and Q1 are used to provide an additional current to the integrating capacitors.

During retrace in the time range .01 to .1 sec., this current is shorted to ground by the Time Switch. The output voltage of IC6 pin 6 is applied to 0 to IC11 that clips the top and bottom of the waveform. The output voltage IC11 pin 7 is 0 to +5.6 volts and is amplified by IC12 to 0 to +10 volts. R33 is the sweep fullscale calibration and R34 is the sweep zero calibration adjustment.

4.4 EXTERNAL SWEEP

IC1 is an external sweep amplifier. R4 is for full scale calibration & R3 is for external zero calibration. IC2 is an inverter with a gain of -1.

4.5 SWEEP OUTPUT

IC13 is the sweep output amplifier and provides 0 to +10 volts. R49 is the sweep output calibration.

4.6 FUNCTION CONTROL

IC14 is the function control section. 0 to 10 volts is applied to IC14 section D and is inverted. R54 and R53 (Front Panel Controls) are gain adjustments for F1 controls. R55 is F1 full scale calibration and R52 is the F1 off calibration. IC14 section C inverts the signals and applies it to IC14 section B which is a summing amplifier. The 0 to +10 volts is also applied to IC14 section A which control F2, an inverting amplifier. F2 controls, R63 and R64 (Front Panel Controls) set the gain and R65 is the F2 full scale calibration. The output of IC14 is also applied to IC14 section B.

4.7 YIG DRIVER

IC15 is the summing amplifier for the Yig Driver. The drive voltage is applied through R73, R70 and R72. An offset is provided by R69 and R71. IC16 is a voltage follower with current boosting transistors Q3, 4, 5, and 6. CR14 is a protection diode for Q6. R81 is the current sense resistor and provides a proportional voltage back to IC16. The collector of Q6 provides the drive current to the Yig Filter. The Calibration switch on the front panel is used to short the drive current to the Yig Filter, eliminating the Yig filter hysteresis. R104 is used for filter calibration at the low frequency end and R70 is used for filter calibration at the high frequency end.

4.8 SAMPLING PULSE GENERATOR

IC20 is a dual one shot circuit that generates the F1 and F2 sampling pulse. One on each edge of the blanking pulse, which is generated by the sweep circuit.

4.9 DISPLAY SAMPLING SECTION

The output of IC14 is applied to the inverting amplifier IC17, and drives the analog output section IC18, a sample and hold circuit. When in sweep mode, the F1 or F2 sampling pulse will sample the voltage applied to IC18 pin 2, and stores it on capacitor C35. If not in sweep mode IC18, functions as a voltage follower. IC19 is used to calibrate the frequency display and provides an inverting function. R98 provides display low end calibration and R87 display high end calibration.

4.10 DISPLAY

The display is a completely integrated digital voltmeter with its own reference. Adjustment for full scale is provided directly on the board.

4.11 ANALOG OUTPUT SECTION

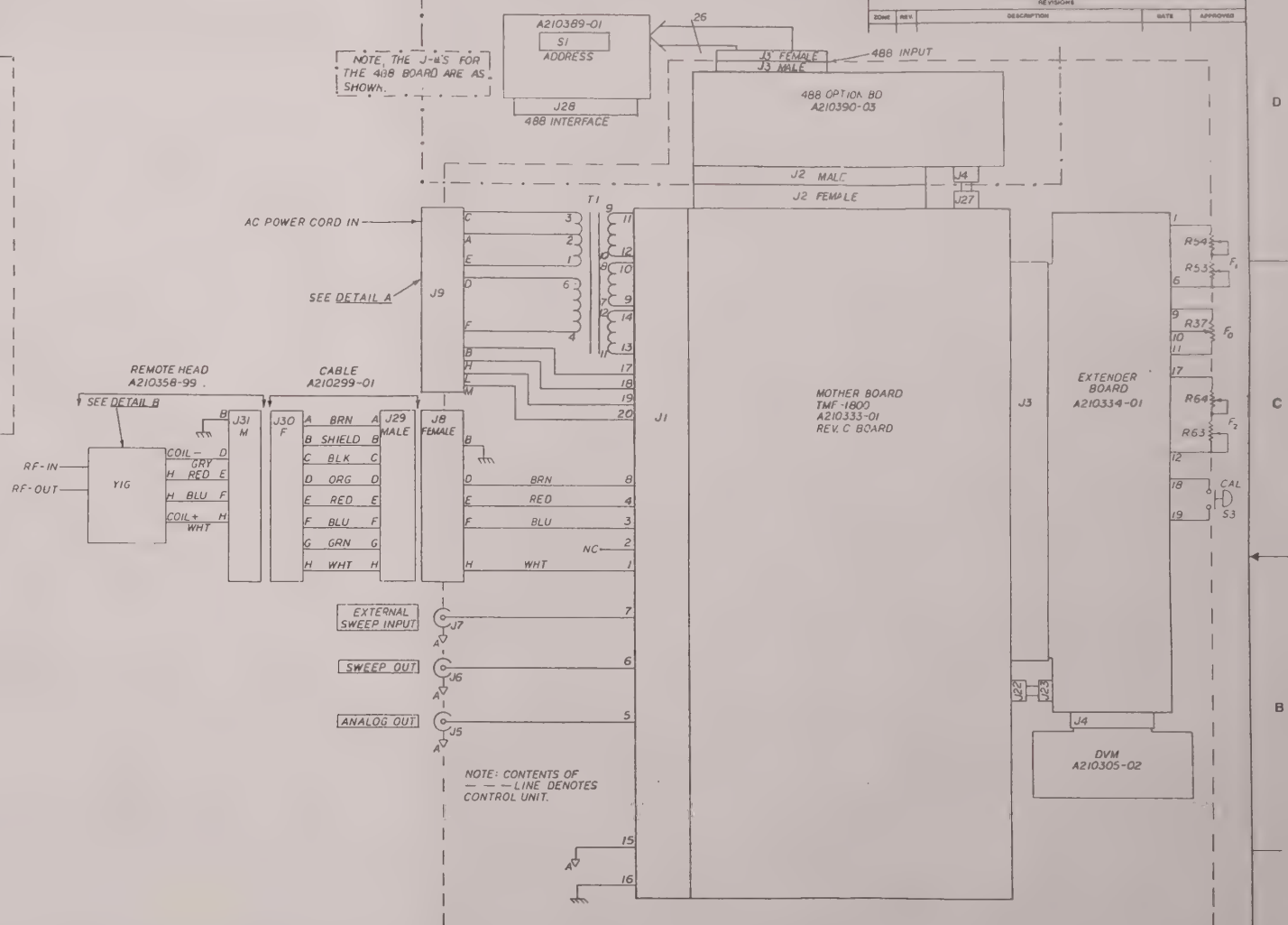
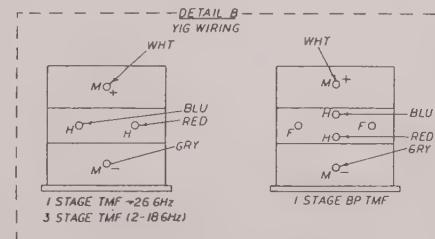
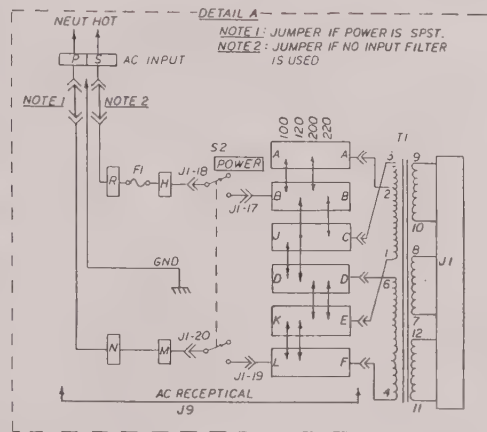
IC21 is an inverting amplifier providing an analog output signal proportional to frequency. This output section is calibrated by R99 (analog low) and by R94 (analog high).

4.12 LINEARIZER CIRCUIT

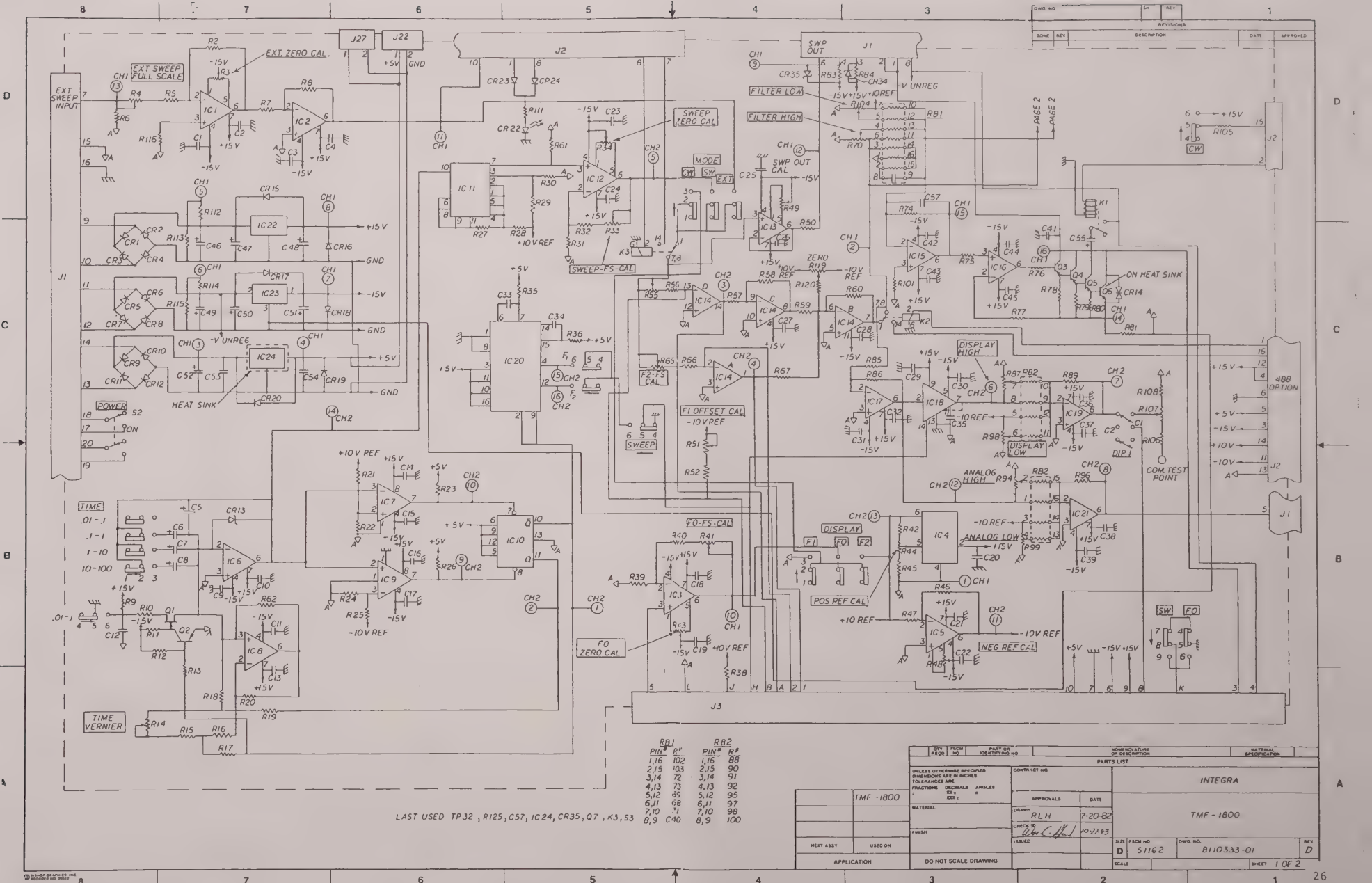
IC25 and its associate circuitry make up the linearizer circuit. The adjustment for this circuit are factory adjusted and should not be modified in the field.

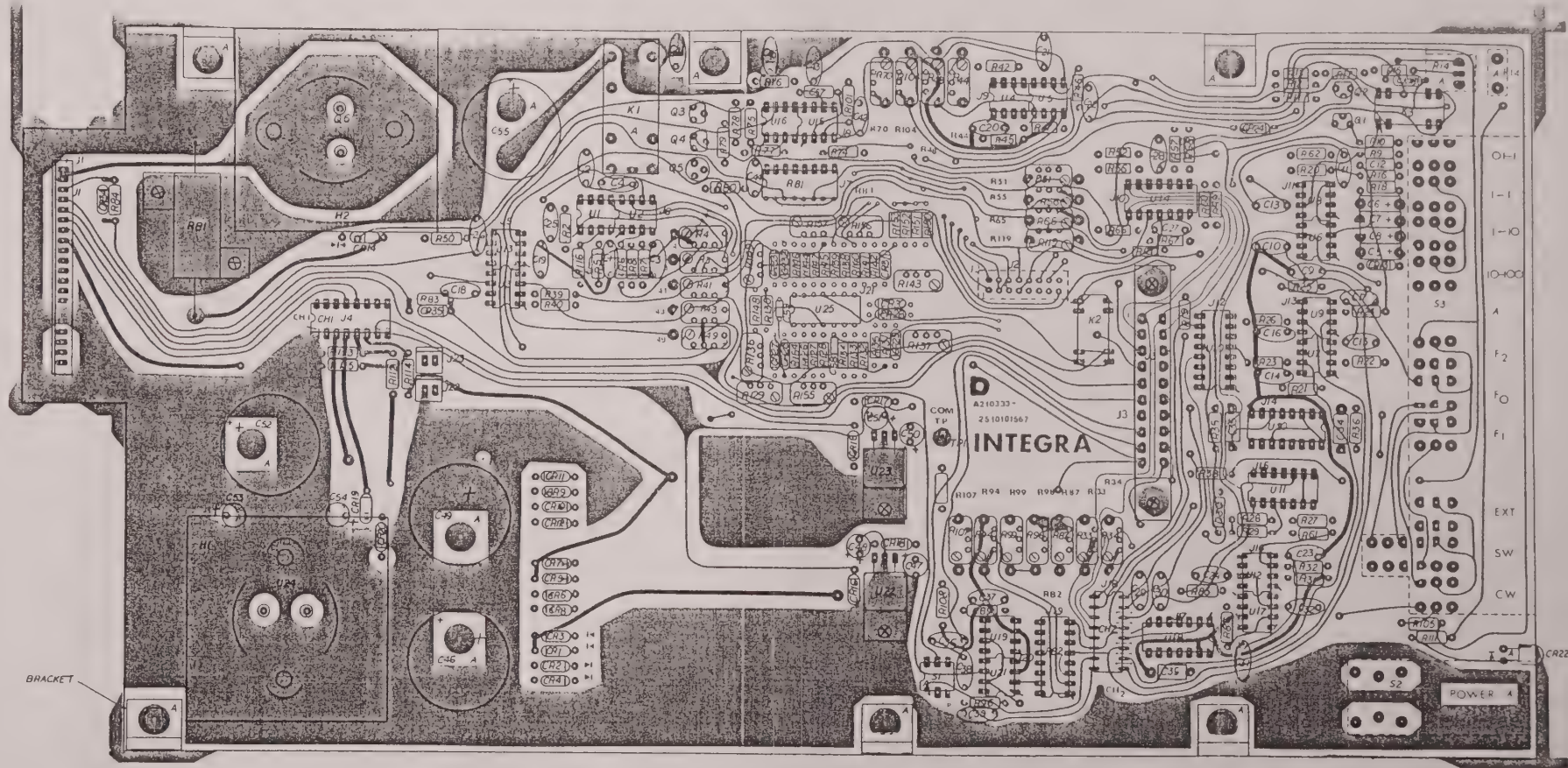
4.13 POWER SUPPLY

T1 is a power transformer with 3 secondary windings. Each output has a fullwave rectifier and integrated voltage regulator. CR15 to CR20 are protection diodes.



QTY	FROM	PART OR IDENTIFICATION NO.	DESCRIPTION	REVISION	DATE	APPROVED
1	100	100	100	100	100	100
PARTS LIST						
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES XXX .XXX .XXX						
CONTRACT NO.			INTEGRA			
APPROVALS			INNERCONNECT			
DRAWN RLH			7-14-82			
CHECKED						
ISSUED						
MATERIAL						
FINISH						
MEET ASBY						
USED ON						
APPLICATION			DO NOT SCALE DRAWING			
SIZE / FROM NO.			D 51162			
SCALE			B110336-01			
SHEET			REV C			



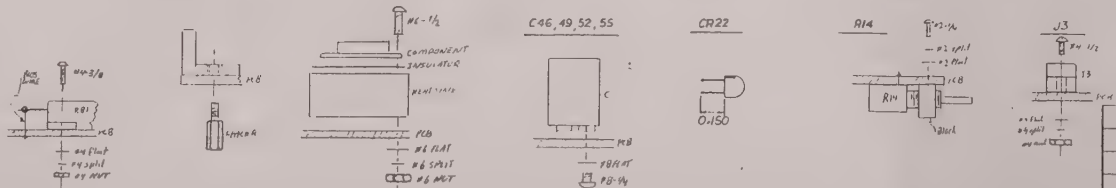


R 81

MOUNTING BRACKET

U 24, Q 6

NOTE: ALL ITEMS MARKED WITH "A" ARE SECOND ASSEMBLY
ALL ITEMS ON NON-COMP SIDE MUST BE MOUNTED FLUSH TO BOARD



QTY EACH		PCH NO		PART OR INSTEAD NO		HOMECENTRE DESCRIPTION		MATERIAL DESCRIPTION	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS DECIMALS ANGLES 1/16 1/32 1/64 1/8 1/4 1/2 3/4 1 1 1/2 2 3 4 5 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100 102 104 106 108 110 112 114 116 118 120 122 124 126 128 130 132 134 136 138 140 142 144 146 148 150 152 154 156 158 160 162 164 166 168 170 172 174 176 178 180 182 184 186 188 190 192 194 196 198 200 202 204 206 208 210 212 214 216 218 220 222 224 226 228 230 232 234 236 238 240 242 244 246 248 250 252 254 256 258 260 262 264 266 268 270 272 274 276 278 280 282 284 286 288 290 292 294 296 298 300 302 304 306 308 310 312 314 316 318 320 322 324 326 328 330 332 334 336 338 340 342 344 346 348 350 352 354 356 358 360 362 364 366 368 370 372 374 376 378 380 382 384 386 388 390 392 394 396 398 400 402 404 406 408 410 412 414 416 418 420 422 424 426 428 430 432 434 436 438 440 442 444 446 448 450 452 454 456 458 460 462 464 466 468 470 472 474 476 478 480 482 484 486 488 490 492 494 496 498 500 502 504 506 508 510 512 514 516 518 520 522 524 526 528 530 532 534 536 538 540 542 544 546 548 550 552 554 556 558 560 562 564 566 568 570 572 574 576 578 580 582 584 586 588 590 592 594 596 598 600 602 604 606 608 610 612 614 616 618 620 622 624 626 628 630 632 634 636 638 640 642 644 646 648 650 652 654 656 658 660 662 664 666 668 670 672 674 676 678 680 682 684 686 688 690 692 694 696 698 700 702 704 706 708 710 712 714 716 718 720 722 724 726 728 730 732 734 736 738 740 742 744 746 748 750 752 754 756 758 760 762 764 766 768 770 772 774 776 778 780 782 784 786 788 790 792 794 796 798 800 802 804 806 808 810 812 814 816 818 820 822 824 826 828 830 832 834 836 838 840 842 844 846 848 850 852 854 856 858 860 862 864 866 868 870 872 874 876 878 880 882 884 886 888 890 892 894 896 898 900 902 904 906 908 910 912 914 916 918 920 922 924 926 928 930 932 934 936 938 940 942 944 946 948 950 952 954 956 958 960 962 964 966 968 970 972 974 976 978 980 982 984 986 988 990 992 994 996 998 1000 1002 1004 1006 1008 1010 1012 1014 1016 1018 1020 1022 1024 1026 1028 1030 1032 1034 1036 1038 1040 1042 1044 1046 1048 1050 1052 1054 1056 1058 1060 1062 1064 1066 1068 1070 1072 1074 1076 1078 1080 1082 1084 1086 1088 1090 1092 1094 1096 1098 1100 1102 1104 1106 1108 1110 1112 1114 1116 1118 1120 1122 1124 1126 1128 1130 1132 1134 1136 1138 1140 1142 1144 1146 1148 1150 1152 1154 1156 1158 1160 1162 1164 1166 1168 1170 1172 1174 1176 1178 1180 1182 1184 1186 1188 1190 1192 1194 1196 1198 1200 1202 1204 1206 1208 1210 1212 1214 1216 1218 1220 1222 1224 1226 1228 1230 1232 1234 1236 1238 1240 1242 1244 1246 1248 1250 1252 1254 1256 1258 1260 1262 1264 1266 1268 1270 1272 1274 1276 1278 1280 1282 1284 1286 1288 1290 1292 1294 1296 1298 1300 1302 1304 1306 1308 1310 1312 1314 1316 1318 1320 1322 1324 1326 1328 1330 1332 1334 1336 1338 1340 1342 1344 1346 1348 1350 1352 1354 1356 1358 1360 1362 1364 1366 1368 1370 1372 1374 1376 1378 1380 1382 1384 1386 1388 1390 1392 1394 1396 1398 1400 1402 1404 1406 1408 1410 1412 1414 1416 1418 1420 1422 1424 1426 1428 1430 1432 1434 1436 1438 1440 1442 1444 1446 1448 1450 1452 1454 1456 1458 1460 1462 1464 1466 1468 1470 1472 1474 1476 1478 1480 1482 1484 1486 1488 1490 1492 1494 1496 1498 1500 1502 1504 1506 1508 1510 1512 1514 1516 1518 1520 1522 1524 1526 1528 1530 1532 1534 1536 1538 1540 1542 1544 1546 1548 1550 1552 1554 1556 1558 1560 1562 1564 1566 1568 1570 1572 1574 1576 1578 1580 1582 1584 1586 1588 1590 1592 1594 1596 1598 1600 1602 1604 1606 1608 1610 1612 1614 1616 1618 1620 1622 1624 1626 1628 1630 1632 1634 1636 1638 1640 1642 1644 1646 1648 1650 1652 1654 1656 1658 1660 1662 1664 1666 1668 1670 1672 1674 1676 1678 1680 1682 1684 1686 1688 1690 1692 1694 1696 1698 1700 1702 1704 1706 1708 1710 1712 1714 1716 1718 1720 1722 1724 1726 1728 1730 1732 1734 1736 1738 1740 1742 1744 1746 1748 1750 1752 1754 1756 1758 1760 1762 1764 1766 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2168 2170 2172 2174 2176 2178 2180 2182 2184 2186 2188 2190 2192 2194 2196 2198 2200 2202 2204 2206 2208 2210 2212 2214 2216 2218 2220 2222 2224 2226 2228 2230 2232 2234 2236 2238 2240 2242 2244 2246 2248 2250 2252 2254 2256 2258 2260 2262 2264 2266 2268 2270 2272 2274 2276 2278 2280 2282 2284 2286 2288 2290 2292 2294 2296 2298 2300 2302 2304 2306 2308 2310 2312 2314 2316 2318 2320 2322 2324 2326 2328 2330 2332 2334 2336 2338 2340 2342 2344 2346 2348 2350 2352 2354 2356 2358 2360 2362 2364 2366 2368 2370 2372 2374 2376 2378 2380 2382 2384 2386 2388 2390 2392 2394 2396 2398 2400 2402 2404 2406 2408 2410 2412 2414 2416 2418 2420 2422 2424 2426 2428 2430 2432 2434 2436 2438 2440 2442 2444 2446 2448 2450 2452 2454 2456 2458 2460 2462 2464 2466 2468 2470 2472 2474 2476 2478 2480 2482 2484 2486 2488 2490 2492 2494 2496 2498 2500 2502 2504 2506 2508 2510 2512 2514 2516 2518 2520 2522 2524 2526 2528 2530 2532 2534 2536 2538 2540 2542 2544 2546 2548 2550 2552 2554 2556 2558 2560 2562 2564 2566 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4568 4570 4572 4574 4576 4578 4580 4582 4584 4586 4588 4590 4592 4594 4596 4598 4600 4602 4604 4606 4608 4610 4612 4614 4616 4618 4620 4622 4624 4626 4628 4630 4632 4634 4636 4638 4640 4642 4644 4646 4648 4650 4652 4654 4656 4658 4660 4662 4664 4666 4668 4670 4672 4674 4676 4678 4680 4682 4684 4686 4688 4690 4692 4694 4696 4698 4700 4702 4704 4706 4708 4710 4712 4714 4716 4718 4720 4722 4724 4726 4728 4730 4732 4734 4736 4738 4740 4742 4744 4746 4748 4750 4752 4754 4756 4758 4760 4762 4764 4766 4768 4770 4772 4774 4776 4778 4780 4782 4784 4786 4788 4790 4792 4794 4796 4798 4800 4802 4804 4806 4808 4810 4812 4814 4816 4818 4820 4822 4824 4826 4828 4830 4832 4834 4836 4838 4840 4842 4844 4846 4848 4850 4852 4854 4856 4858 4860 4862 4864 4866 4868 4870 4872 4874 4876 4878 4880 4882 4884 4886 4888 4890 4892 4894 4896 4898 4900 4902 4904 4906 4908 4910 4912 4914 4916 4918 4920 4922 4924 4926 4928 4930 4932 4934 4936 4938 4940 4942 4944 4946 4948 4950 4952 4954 4956 4958 4960 4962 4964 4966 4968 4970 4972 4974 4976 4978 4980 4982 4984 4986 4988 4990 4992 4994 4996 4998 5000 5002 5004 5006 5008 5010 5012 5014 5016 5018 5020 5022 5024 5026 5028 5030 5032 5034 5036 5038 5040 5042 5044 5046 5048 5050 5052 5054 5056 5058 5060 5062 5064 5066 5068 5070 5072 5074 5076 5078 5080 5082 5084 5086 5088 5090 5092 5094 5096 5098 5100 5102 5104 5106 5108 5110 5									

0 CALIBRATION

1 CALIBRATION PROCEDURE FOR TMF-1800A AND E (2-26.5 GHZ)

See Figure 5 for test set-up and equipment list.

Connect filter and apply AC power. Allow 30 minute warm-up before performing test.

TEST #	SET-UP/INPUTS	DVM ON	OSC ON	ADJ	MEASURE/ADJUST FOR
1	<u>+10V REF</u> Ref ADJ	CH2 13		R44	+10.000V $\pm$.001
2	<u>-10V REF</u> Ref ADJ	CH2 11		R48	-10.000V $\pm$.001
3	<u>Fo VOLT ADJ</u> Select Fo, CW Mode Turn Fo control CCW	CH1 10		R43	0.000V $\pm$.001
3A	Turn Fo Control CW	CH1 10		R41	+10.000V $\pm$.001
4	<u>F1 to F2 VOLT ADJ</u> Select F1, CW mode. F1 & F2 controls CCW, Verniers also.	CH1 2		R119	0.000V $\pm$.001
4A	Turn F1 control CW	CH1 2		R51	+10.000V $\pm$.001
4B	Select F2	CH1 2		R55	0.000V $\pm$.001
4C	Turn F2 controls CW.	CH1 2		R65	+10.000V $\pm$.001
5	<u>DVM ADJ</u> Select F2, CW Mode. F2 controls CW. DVM GND on display conn. J3-5.	J3-H		Display R18	Observe readout match DVM reading.

5.1 PROCEDURE CAL TMF-1800A & E CONT

TEST #	SET-UP/INPUTS	DVM	OSC	MEASURE/ADJUST FOR
		ON	ON ADJ	
6	<u>DISPLAY ADJ</u> Select F1, CW Mode. Turn F1 controls CCW.	J3-H	R98	Observe display ADJ for 1.98 GHZ
6A	Select F2. Turn F2 controls CW.	J3-H	R87	Observe display 26.52 GHZ.
7	<u>ANALOG OUT ADJ</u> Select Fo, CW Mode. F2 controls CW, Fo CCW.	Analog out	R99	+ .990V $\pm$.001
7A	Fo control CW		R94	13.260V $\pm$.002
8	<u>FILTER FREQ ADJ</u> Refer to Figure 5 for Test Set-Up. Set the RF source to 2.000 GHZ.			
8A	Set the Fo control for a 2.00 GHZ reading on the TMF.		R104	ADJ for maximum power on scope.
8B	Set the RF Source to 24.000 GHZ Set the Fo control for 24.00 GHZ.		R70	ADJ for maximum power on scope.
8C	Repeat steps A & B until both are correct.			
9	<u>SWEEP DISPLAY CALIB</u> TMF set-up, note exact display reading, switch to swp mode, fastest sweep mode.		R34	Set TMF display for same reading as CW mode reading.
9A	Select CW mode, select F2 display. Set F2 controls for 26.5 GHZ, switch to sweep mode.		R33	Set TMF display for same reading as CW mode reading.

5.2 CALIBRATION PROCEDURE FOR TMF-1800B AND C (2-18.5 GHZ)

See Figure 5 for test set-up and equipment list.
Connect filter and apply AC power. Allow 30 minute warm-up before performing test.

TEST #	SET-UP/INPUTS	DVM ON	OSC ON	ADJ	MEASURE/ADJUST FOR
1	<u>+10V REF</u> Ref ADJ	CH2 13		R44	+10.000V $\pm$.001
2	<u>-10V REF</u> Ref ADJ	CH2 11		R48	-10.000V $\pm$.001
3	<u>Fo VOLT ADJ</u> Select Fo, CW Mode Turn Fo control CCW	CH1 10		R43	0.000V $\pm$.001
3A	Turn Fo Control CW	CH1 10		R41	+10.000V $\pm$.001
4	<u>F1 to F2 VOLT ADJ</u> Select F1, CW mode. F1 & F2 controls CCW, Verniers also.	CH1 2		R119	0.000V $\pm$.001
4A	Turn F1 controls CW. CW, F2 controls CCW	CH1 2		R51	+10.000V $\pm$.001
4B	Select F2	CH1 2		R55	0.000V $\pm$.001
4C	Turn F2 controls CW.	CH1 2		R65	+10.000V $\pm$.001
5	<u>DVM ADJ</u> Select F2, CW Mode. F2 controls CW. DVM GND on display conn. J3-5.	J3-H		Display R18	Observe readout match DVM reading.
6	<u>DISPLAY ADJ</u> Select F1, CW Mode. Turn F1 controls CCW.	J3-H		R98	Observe display ADJ for 1.980 GHZ
6A	Select F2. Turn F2 controls CW.	J3-H		R87	Observe display 18.520 GHZ.

5.2 PROCEDURE CAL TMF-1800B & C CONT

#	TEST SET-UP/INPUTS	DVM	OSC	MEASURE/ADJUST FOR
		ON	ON ADJ	
7	<u>ANALOG OUT ADJ</u> Select Fo, CW Mode. F2 controls CW, Fo CCW.	Analog out	R99	+9.990V $\pm$.001
7A	Fo control CW		R94	+9.260V $\pm$.002
NOTE: If YIG being used requires linearity correction skip step 8 & go to step 9.				
8	<u>FILTER FREQ ADJ</u> Refer to Figure 5 for Test Set-Up. Set the RF source to 2.000 GHZ.			
8A	Set the Fo control for a 2.000 GHZ reading on the TMF.		R104	ADJ for maximum power on scope.
8B	Set the RF Source to 16.000 GHZ Set the Fo control for 16.000 GHZ.		R70	ADJ for maximum power on scope.
8C	Repeat steps A & B until both are correct.			
9	<u>SWEEP DISPLAY CALIB</u> TMF set-up, note exact display reading, switch to swp mode, fastest sweep mode.		R34	Set TMF display for same reading as CW mode reading.
9A	Select CW mode, select F2 display. Set F2 controls for 18.5 GHZ, switch to sweep mode.		R33	Set TMF display for same reading as CW mode reading.

5.3 CALIBRATION PROCEDURE FOR TMF-1800D1 & D2 (.5-2 GHZ)

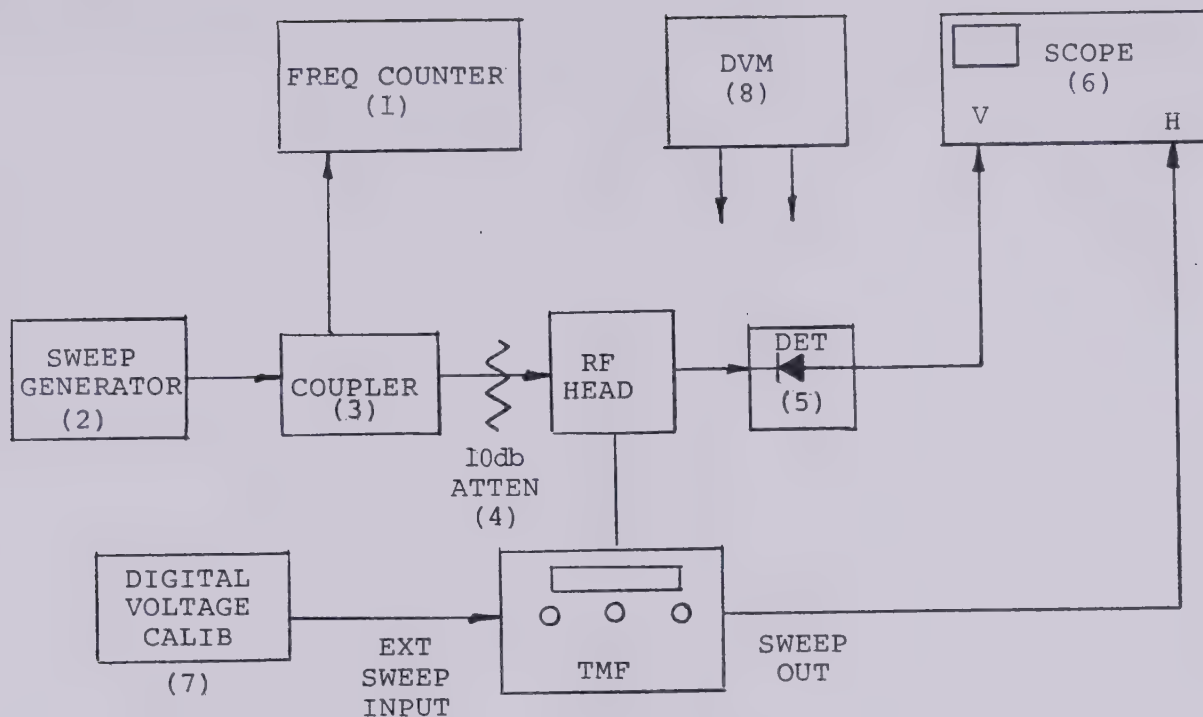
See Figure 5 for test set-up and equipment list.

Connect filter and apply AC power. Allow 30 minute warm-up before performing test.

TEST #	SET-UP/INPUTS	DVM ON	OSC ON	ADJ	MEASURE/ADJUST FOR
1	<u>+10V REF</u> Ref ADJ	CH2 13		R44	+10.000V $\pm$.001
2	<u>-10V REF</u> Ref ADJ	CH2 11		R48	-10.000V $\pm$.001
3	<u>Fo VOLT ADJ</u> Select Fo, CW Mode Turn Fo control CCW	CH1 10		R43	0.000V $\pm$.001
3A	Turn Fo Control CW	CH1 10		R41	+10.000V $\pm$.001
4	<u>F1 to F2 VOLT ADJ</u> Select F1, CW mode. F1 & F2 controls CCW, Verniers also.	CH1 2		R119	0.000V $\pm$.001
4A	Turn F1 controls CW.	CH1 2		R51	+10.000V $\pm$.001
4B	Select F2	CH1 2		R55	0.000V $\pm$.001
4C	Turn F2 controls CW.	CH1 2		R65	+10.000V $\pm$.001
5	<u>DVM ADJ</u> Select F2, CW Mode. F2 controls CW. DVM GND on display conn. J3-5.	J3-H		Display R18	Observe readout match DVM reading.
6	<u>DISPLAY ADJ</u> Select F1, CW Mode. Turn F1 controls CCW.	J3-H		R98	Observe display ADJ for .490 GHZ
6A	Select F2. Turn F2 controls CW.	J3-H		R87	Observe display 2.020 GHZ.

5.3 PROCEDURE CAL TMF-1800D1 & D2

TEST #	SET-UP/INPUTS	DVM ON	OSC ON	ADJ	MEASURE/ADJUST FOR
7	<u>ANALOG OUT ADJ</u> Select Fo, CW Mode. F2 controls CW, Fo CCW.	Analog out		R99	+ .245V $\pm$.001
7A	Fo control CW			R94	+1.010V $\pm$.002
8	<u>FILTER FREO ADJ</u> Refer to Figure 5 for Test Set-Up. Set the RF source to 2.000 GHZ.				
8A	Set the Fo control for a .500 GHZ reading on the TMF.			R104	ADJ for maximum power on scope.
8B	Set the RF Source to 2.000 GHZ Set the Fo control for 2.000 GHZ.			R70	ADJ for maximum power on scope.
8C	Repeat steps A & B until both are correct.				
9	<u>SWEEP DISPLAY CALIB</u> TMF set-up, note exact display reading, switch to swp mode, fastest sweep mode.			R34	Set TMF display for same reading as CW mode reading.
9A	Select CW mode, select F2 display. Set F2 controls for 2.00 GHZ, switch to sweep mode.			R33	Set TMF display for same reading as CW mode reading.

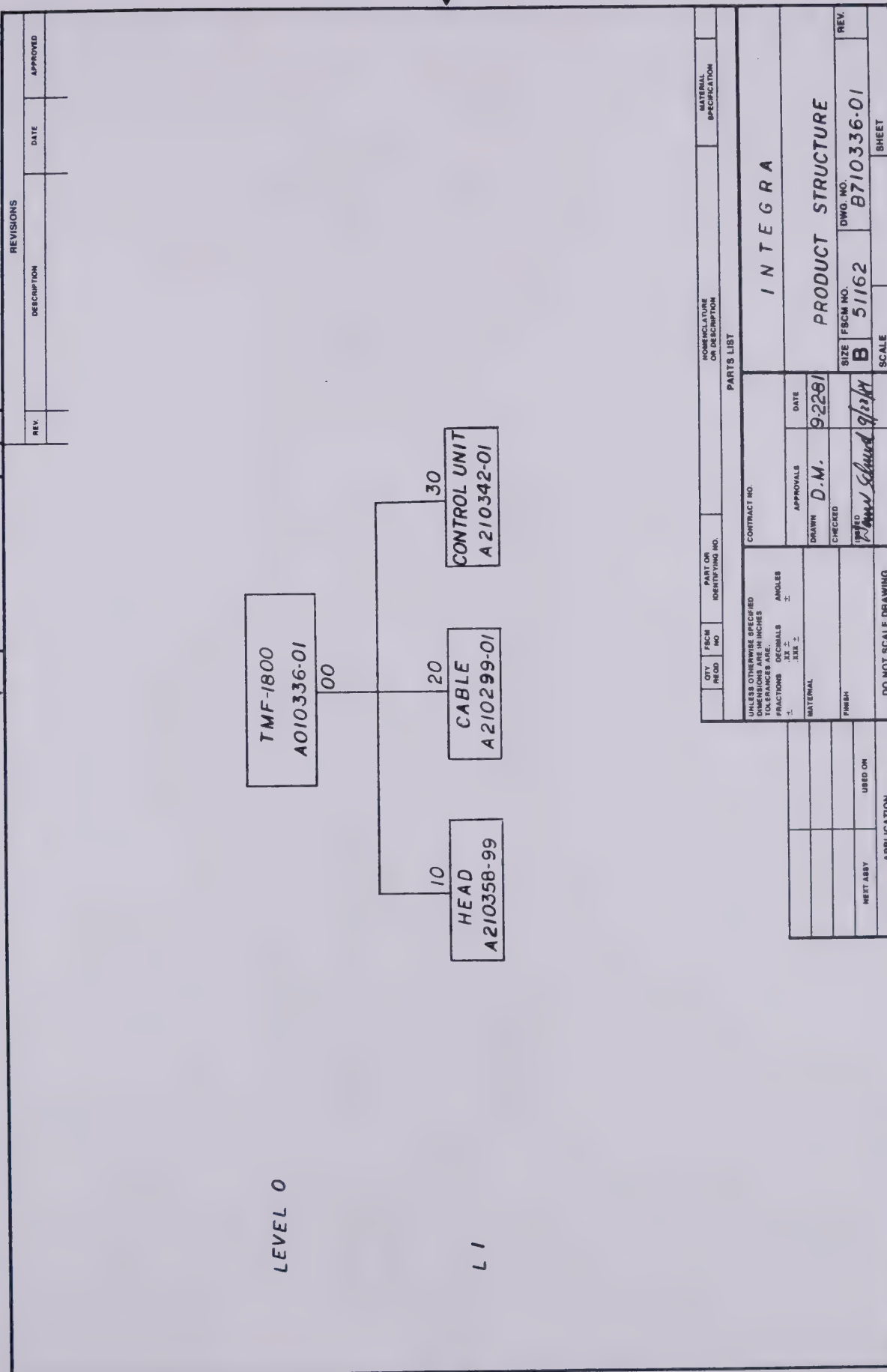


TEST EQUIPMENT LIST

ITEM	MODEL NO.	MFG
1 Frequency Counter	5342A	HP
2 Sweep Generator	8350B/83595A	HP
3 Directional Coupler	1818	Krytar
4 Attenuator	8493B-10	HP
5 Detector	33330C	HP
6 Oscilloscope	2215	Tektronix
7 Digital Voltage Calibrator	DVC-8500	Datel-Intersil
8 Digital Voltmeter	3478A	HP

CALIBRATION TEST SET-UP
Figure 7

6.0 PARTS LIST



QTY REQD		FORM NO.		PART OR IDENTIFYING NO.		CONTRACT NO.		PARTS LIST		NOMENCLATURE OR DESCRIPTION		MATERIAL SPECIFICATION					
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES $\frac{1}{16}$.005 15'								APPROVALS		DATE		I N T E G R A PRODUCT STRUCTURE					
								DRAWN		D.M.						9-22-61	
								CHECKED									
								ISSUED		Don W. Schuch						9/22/61	
FINISH				SCALE		SIZE		FORM NO.		DWG. NO.		REV.					
				B		51162		B710336-01									
DO NOT SCALE DRAWING												SHEET					

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210342-01
USED ON TMF-1800
NEXT ASSEMBLY STOCK
TITLE TMF-CONTROL UNIT

PAGE 1 OF 1

1	2	7	9	17	18	19	40	43	44	45	63	64	70	71	80				
TC	DATE	CC	PART	NUMBER	SUFF	REV	DESCRIPTION	QUA	U/M	SRC	E/F	REF	DESIGNATION	M	T/P	L	NEXT	ASSY	C
A2	10342-01						CONTROL UNIT	010	E	C	0001		0	0	5		STOCK		
A2	10305-02						DVM	010	E	7	0001		0	1	5		10342-01		
A2	10419-01						CABLE ASSY	010	E	C	0001		0	1	5		10342-01		
41	10273-04						ENCLOSURE	010	E	7	0001		0	1	5		10342-01		
41	10100270						KNOB	030	E	7	0001		0	1	5		10342-01		
41	10100272						CAP	030	E	7	0001		0	1	5		10342-01		
41	10100281						RETAINER, STRAP	040	E	7	0001		0	1	5		10101776		
41	10100283						FEET	050	E	7	0001		0	1	5		10342-01		
41	10100470						EXTRU, FRONT	020	E	7	0001		0	1	5		10342-01		
41	10100778						KNOB	030	E	7	0001		0	1	5		10342-01		
41	10100779						CAP	030	E	7	0001		0	1	5		10342-01		
41	10101027						BUTTON	010	E	7	0001		0	1	5		10342-01		
41	10101224						PANEL, DECORATIVE	020	E	7	0001		0	1	5		10342-01		
41	10101225						STRAP	020	E	7	0001		0	1	5		10342-01		
41	10101582						COVER, TOP	010	E	7	0001		0	1	5		10342-01		
41	10101583						COVER, BOTTOM	010	E	7	0001		0	1	5		10342-01		
42	10303-16						SCREW, #6-3/4, BLK	040	E	7	0001		0	1	5		10342-01		
42	10100277						SCREW, #6-3/4	080	E	7	0001		0	1	5		10342-01		
42	10100284						SCREW, #6-ST	050	E	7	0001		0	1	5		10342-01		
42	10100334						NUT, HEX #8	040	E	7	0001		0	1	5		10342-01		
42	10100335						SCREW, SPOTWELD	040	E	7	0001		0	1	5		10342-01		
42	10100337						SCREW, #8-1/2	040	E	7	0001		0	1	5		10342-01		
42	10101657						STANDOFF, HEX	060	E	7	0001		0	1	5		10342-01		
43	10100074						WASH, #6 FL	040	E	7	0001		0	1	5		10342-01		
43	10100075						WASH, #6 SPL	040	E	7	0001		0	1	5		10342-01		
43	10100278						WASHER, NYLON	080	E	7	0001		0	1	5		10342-01		
72	10101776						RETAINER, STRAP	040	E	7	0001		0	1	5		10342-01		

1	2	7	9	17	18	19	40	43	44	45	63	64	70	71	80
TC	DATE	CC	PART NUMBER	SUFF	REV	DESCRIPTION	QUA	U/M	SRC	E/F	REF DESIGNATION	M	T/P	L	C
A2	10333-01					MOTHER BOARD	010	E	C	0001		D	10	1	10342-01
13	10100088					C CER .01UF	390	E	7	0001	C 1-4,9-32,36-39, 41-45,58,59	D	10	2	10333-01
13	10100122					C TANT .33UF	010	E	7	0001	C 5	D	10	2	10333-01
13	10100138					C ELEC 5500UF	010	E	7	0001	C 52	D	10	2	10333-01
13	10100158					C TANT 33UF	010	E	7	0001	C 7	D	10	2	10333-01
13	10100159					C TANT 330UF	010	E	7	0001	C 8	D	10	2	10333-01
13	10100543					C CER .01UF	020	E	7	0001	C 33,34	D	10	2	10333-01
13	10101247					C ELEC 3600UF	030	E	7	0001	C 46,49,55	D	10	2	10333-01
13	10101367					C FILM .22UF	010	E	7	0001	C 35	D	10	2	10333-01
13	10101900					C ELEC 10UF	030	E	7	0001	C 48,51,54	D	10	2	10333-01
13	10101901					C ELEC 1UF	030	E	7	0001	C 47,50,53	D	10	2	10333-01
13	10101904					C ELEC 3.3UF	010	E	7	0001	C 6	D	10	2	10333-01
15	10100019					DIODE, IN4148	100	E	7	0001	CR 23,24,26-33	D	10	2	10333-01
15	10100183					DIODE, IN5240	010	E	7	0001	CR 13	D	10	2	10333-01
15	10100355					DIODE, L 51A	010	E	7	0001	CR 14	D	10	2	10333-01
15	10101633					DIODE, IN4004	180	E	7	0001	CR 1-12,15-20	D	10	2	10333-01
17	10100382					LED, RED	010	E	7	0001	CR 22	D	10	2	10333-01
19	10100045					IC, LAS 1505	010	E	7	0001	U 24	D	10	2	10333-01
19	10100114					IC, LM 741CN	050	E	7	0001	U 1,3,5,12,13	D	10	2	10333-01
19	10100116					IC, LM 307CN	080	E	7	0001	U 2,6,8,15,16, 17,19,21	D	10	2	10333-01
19	10100117					IC, SN 7476N	010	E	7	0001	U 10	D	10	2	10333-01
19	10100118					IC, CA 3046	010	E	7	0001	U 11	D	10	2	10333-01
19	10100458					IC, SN74123N	010	E	7	0001	U 20	D	10	2	10333-01
19	10100709					IC, LM 348N	020	E	7	0001	U 14,25	D	10	2	10333-01
19	10100741					IC, REF-01CJ	010	E	7	0001	U 4	D	10	2	10333-01
19	10101083					IC, SMP 81 FY	010	E	7	0001	U 18	D	10	2	10333-01
19	10101256					IC, LM 311N	020	E	7	0001	U 7,9	D	10	2	10333-01
19	10101637					IC, LM 340T-15	010	E	7	0001	U 22	D	10	2	10333-01
19	10101638					IC, LM 320T-15	010	E	7	0001	U 23	D	10	2	10333-01
25	10101567					PCB	010	E	7	0001		D	10	2	10333-01
26	10100413					RELAY	010	E	7	0001	K 1	D	10	2	10333-01
26	10101629					RELAY, REED	020	E	7	0001	K 2,3	D	10	2	10333-01
27	10100107					R CARB 100	010	E	7	0001	R 50	D	10	2	10333-01
27	10100110					R CARB 10K	050	E	7	0001	R 13,23,26,75,79	D	10	2	10333-01
27	10100185					R CARB 68K	010	E	7	0001	R 12	D	10	2	10333-01
27	10100186					R CARB 27	010	E	7	0001	R 15	D	10	2	10333-01
27	10100217					R MF 9.09K	010	E	7	0001	R 61	D	10	2	10333-01
27	10100220					R MF 499	030	E	7	0001	R 29,38,40	D	10	2	10333-01
27	10100225					R CARB 33K	020	E	7	0001	R 35,36	D	10	2	10333-01
27	10100228					R CARB 56K	010	E	7	0001	R 116	D	10	3	10333-01
27	10100285					R MF 6.34K	010	E	7	0001	R 21	D	10	2	10333-01
27	10100286					R MF 20.0K	040	E	7	0001	R 112,113,114,115	D	10	2	10333-01
27	10100289					R MF 10.0K	030	E	7	0001	R 7,31,96	D	10	2	10333-01

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210333-01-D
USED ON TMF-CONTROL UNIT
NEXT ASSEMBLY A210342-01
TITLE MOTHER BOARD

PAGE 2 OF 3

1	2	7	9	17	18	19	40	43	44	45	63	64	70	71	80
TC	DATE	CC	PART NUMBER	SUFF	REV	DESCRIPTION	QUA	U/M	SRC	E/F	M	T/P	L	NEXT ASSY	C
						R MF 9.53K	030	E	7	0001	D	10	2	10333-01	5
			27 10100291			R MF 1.10K	020	E	7	0001	D	10	2	10333-01	5
			27 10100295			R MF 1.30K	010	E	7	0001	D	10	2	10333-01	5
			27 10100296			R CARB 1K	060	E	7	0001	D	10	2	10333-01	5
			27 10100304												
						R CARB 100K	010	E	7	0001	D	10	2	10333-01	5
			27 10100309			R CARB 15K	050	E	7	0001	D	10	2	10333-01	5
			27 10100310												
						R CARB 13K	010	E	7	0001	D	10	2	10333-01	5
			27 10100367			R WW 3 3%	010	E	7	0001	D	10	2	10333-01	5
			27 10100466			R MF 6.04K	010	E	7	0001	D	10	2	10333-01	5
			27 10100482			R MF 39.2K	010	E	7	0001	D	10	2	10333-01	5
			27 10100585			R MF 191K	010	E	7	0001	D	10	2	10333-01	5
			27 10100588			R MF 100.0K	020	E	7	0001	D	10	2	10333-01	5
			27 10100599			R MF 3.01K	010	E	7	0001	D	10	2	10333-01	5
			27 10100602			R MF 11.0K	010	E	7	0001	D	10	2	10333-01	5
			27 10100604			R CARB 1M	010	E	7	0001	D	10	2	10333-01	5
			27 10100609			R MF 1.00K	010	E	7	0001	D	10	2	10333-01	5
			27 10100610			R CARB 51	050	E	7	0001	D	10	2	10333-01	5
			27 10100614			R CARB 200K	030	E	7	0001	D	10	2	10333-01	5
			27 10100820			R MF 200K	010	E	7	0001	D	10	2	10333-01	5
			27 10100845			R CARB 390	010	E	7	0001	D	10	2	10333-01	5
			27 10100953			R MF 4.99K	050	E	7	0001	D	10	2	10333-01	5
			27 10101033			R MF 13.7K	010	E	7	0001	D	10	2	10333-01	5
			27 10101041			R MF 2.05K	010	E	7	0001	D	10	2	10333-01	5
			27 10101088			R MF 19.1K	010	E	7	0001	D	10	2	10333-01	5
			27 10101270			R MF 2.61K	010	E	7	0001	D	10	2	10333-01	5
			27 10101385			R MF 20.0K .1%	060	E	7	0001	D	10	2	10333-01	5
			27 10101656			R MF 2.00K	010	E	7	0001	D	10	2	10333-01	5
			28 10100802			R VAR 1K	010	E	7	0001	D	10	2	10333-01	5
			28 10101960			R VAR 1K	040	E	7	0001	D	10	2	10333-01	5
			28 10101961			R VAR 2K	020	E	7	0001	D	10	2	10333-01	5
			28 10101962			R VAR 10K	060	E	7	0001	D	10	2	10333-01	5
			28 10101963			R VAR 20K	010	E	7	0001	D	10	2	10333-01	5
			28 10101964			R VAR 100K	070	E	7	0001	D	10	2	10333-01	5
						TRANS, 2N4126	010	E	7	0001	D	10	2	10333-01	5
			30 10100095			TRANS, KE4391	010	E	7	0001	D	10	2	10333-01	5
			30 10100129			TRANS, 2N5401	020	E	7	0001	D	10	2	10333-01	5
			30 10100196			TRANS, MM4001	010	E	7	0001	D	10	2	10333-01	5
			30 10100233			TRANS, 2N6228	010	E	7	0001	D	10	2	10333-01	5
			30 10100237			SOCKET, 14 PIN	040	E	7	0001	D	10	2	10333-01	5
			41 10100384			SOCKET, 16 PIN	140	E	7	0001	D	10	2	10333-01	5
			41 10100128												
						HEATSINK	020	E	7	0001	D	10	2	10333-01	5
			41 10100239			TERMINAL, TP	010	E	7	0001	D	10	2	10333-01	5
			41 10100818			SWITCH	010	E	7	0001	D	10	2	10333-01	5
			41 10101093												

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210333-01-D
USED ON TMF-CONTROL UNIT
NEXT ASSEMBLY A210342-01
TITLE MOTHER BOARD

PAGE 3 OF 3

1	2	7	9	17	18	19	40	43	44	45	63	64	70	71	80				
TC	DATE	CC	PART	NUMBER	SUFF	REV	DESCRIPTION	QUA	U/M	SRC	E/F	REF	DESIGNATION	M	T/P	L	NEXT	ASSY	C
			41	10101552			SWITCH	010	E	7	0001	S 1		D	10	2	10333-01		5
			41	10101618			SWITCH	010	E	7	0001	S 3		D	10	2	10333-01		5
			41	10101622			POST, HEADER	010	E	7	0001	J 1		D	10	2	10333-01		5
			41	10101624			POST, HEADER	020	E	7	0001	J 22, 23		D	10	2	10333-01		5
			41	10101626			CONN, RECEIPT	010	E	7	0001	J 2		D	10	2	10333-01		5
			41	10101628			CONN	010	E	7	0001	J 3		D	10	2	10333-01		5
			41	10101631			DIP, HEADER	010	E	7	0001			D	10	2	10333-01		5
			43	10100188			INSULATOR	020	E	7	0001			D	10	2	10333-01		5
							SCREW #4 X 1/4	020	E	7	0001			D	10	2	10333-01		5
							SCREW #4 X 3/8	020	E	7	0001			D	10	2	10333-01		5
							SCREW #4 X 1/2	020	E	7	0001			D	10	2	10333-01		5
							SCREW #6 X 1/2	040	E	7	0001			D	10	2	10333-01		5
							WASH, #4 FLT	060	E	7	0001			D	10	2	10333-01		5
							WASH, #4 SPL	020	E	7	0001			D	10	2	10333-01		5
							NUT, #4	060	E	7	0001			D	10	2	10333-01		5
							WASH, #6 SPL	040	E	7	0001			D	10	2	10333-01		5
							R SAT	260	E	7	0001	R 126-127, 131-134, 136-141, 143-147, 149-157		D	10	2	10333-01		5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210352-01
USED ON TMF-CONTROL UNIT
NEXT ASSEMBLY A210342-01
TITLE PANEL, SUB

PAGE 1 OF 1

1	2	7	9	17	18	19	40	43	44	45	63	64	70	71	80
TC	DATE	CC	PART NUMBER	SUFF	REV	DESCRIPTION	QUA	U/M	SRC	E/F	M	T/P	L	NEXT ASSY	C
						B									
						PANEL, SUB	010	E	C	0001	D	20	1	10342-01	5
A2	10352-01					R VAR 10K 10T	030	E	7	0001	D	20	2	10352-01	5
28	10100010					R VAR 100, 1T	020	E	7	0001	D	20	2	10352-01	5
31	10100801					WIRE, #26 BLK	010	F	7	0001	D	20	2	10352-01	5
31	10100250					WIRE, #26 BRN	010	F	7	0001	D	20	2	10352-01	5
31	10100251					WIRE, #26 RED	010	F	7	0001	D	20	2	10352-01	5
31	10100252					WIRE, #26 ORG	010	F	7	0001	D	20	2	10352-01	5
31	10100253					WIRE, #26 YEL	010	F	7	0001	D	20	2	10352-01	5
31	10100254					WIRE, #26 GRN	010	F	7	0001	D	20	2	10352-01	5
31	10100255					WIRE, #26 BLU	010	F	7	0001	D	20	2	10352-01	5
31	10100256					WIRE, #26 VIO	010	F	7	0001	D	20	2	10352-01	5
31	10100257					WIRE, #26 GRY	010	F	7	0001	D	20	2	10352-01	5
31	10100258					WIRE, #26 WHT	010	F	7	0001	D	20	2	10352-01	5
31	10100259					WRAP, TIE	090	F	7	0001	D	20	2	10352-01	5
41	10100236					SWITCH	010	E	7	0001	D	20	2	10352-01	5
41	10100987					SCREW, #6 SOC HD	040	E	7	0001	D	20	2	10352-01	5
42	10218-06					SCREW, #4-1/2	020	E	7	0001	D	20	2	10352-01	5
42	10316-00					NUT, HEX #4	020	E	7	0001	D	20	2	10352-01	5
42	10100175					WASH, #4 FL	020	E	7	0001	D	20	2	10352-01	5
43	10100179					WASH, #4 SPL	020	E	7	0001	D	20	2	10352-01	5
43	10100180					BKT, DVM RT	010	E	7	0001	D	20	2	10352-01	5
72	10101572					PANEL, SUB	010	E	7	0001	D	20	2	10352-01	5
72	10101607					BKT, DVM LT	010	E	7	0001	D	20	2	10352-01	5
72	10101695														

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210334-01
USED ON TMF-CONTROL UNIT
NEXT ASSEMBLY A210352-01
TITLE EXTENDER BOARD

PAGE 1 OF 1

1	2	7	9	17	18	19	40	43	44	45	63	64	70	71	80
TC	DATE	CC	PART NUMBER	SUFF	REV	DESCRIPTION	QUA	U/M	SRC	E/F	M	T/P	L	NEXT	C
			A2 10334-01		B	EXTENDER BD	010	E	C	0001	D	21	2	10352-01	5
			25 10101580		B	PCB	010	E	7	0001	D	21	3	10334-01	5
			27 10100110			R CARB 10K	010	E	7	0001	D	21	3	10334-01	5
			27 10100300			R CARB 5.1K	010	E	7	0001	D	21	3	10334-01	5
			30 10100092			TRANS, 2N4124	010	E	7	0001	D	21	3	10334-01	5
			31 10101675			WIRE, #24 GRN	010	E	7	0001	D	21	3	10334-01	5
			31 10101680			WIRE, #24 BLK	010	E	7	0001	D	21	3	10334-01	5
			41 10101624			POST, HEADER	010	E	7	0001	D	21	3	10334-01	5
			41 10101628			CONNECTOR	010	E	7	0001	D	21	3	10334-01	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A110364-01
USED ON TMF-CONTROL UNIT
NEXT ASSEMBLY A210342-01
TITLE PANEL, FRONT

PAGE 1 OF 1

1	2	7	9	17	18	19	40	43	44	45	63	64	70	71	80
TC	DATE	CC	PART NUMBER	SUFF	REV	DESCRIPTION	QUA	U/M	SRC	E/F	M	T/P	L	NEXT ASSY	C
			A1 10364-01			PANEL, FRONT	010	E	C	0001	D	30	1	10342-01	5
			41 10100901			ALUM, BLK	500	C	7	0001	D	30	2	10101668	5
			72 10101570	B		PANEL, FRONT	010	E	7	0001	D	30	2	10364-01	5
			72 10101668			LABEL, FRONT	010	E	3	0001	D	30	2	10364-01	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210362-01
USED ON TMF-CONTROL UNIT
NEXT ASSEMBLY A210342-01
TITLE PANEL, REAR ASSY

PAGE 1 OF 1

1	2	7	9	17	18	19	40	43	44	45	63	64	70	71	80
TC	DATE	CC	PART NUMBER	SUFF	REV	DESCRIPTION	QUA	U/M	SRC	E/F	M	T/P	L	NEXT ASSY	C
			A2 10362-01			PANEL, REAR ASSY	010	E	C	0001	D	40	1	10342-01	5
			16 10100502			FUSE, 1 AMP SB	010	E	7	0001	D	40	2	10362-01	5
			41 10100125			BNC	030	E	7	0001	D	40	2	10362-01	5
			41 10101087			RECEPT, A/C	010	E	7	0001	D	40	2	10362-01	5
			41 10101381			CONN	010	E	7	0001	D	40	2	10362-01	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210343-02
USED ON TMF-CONTROL UNIT
NEXT ASSEMBLY A210362-01
TITLE HARNESS

PAGE 1 OF 1

1	2	7	9	17	18	19	40	43	44	45	49	53	54	57	60	61	63	64	70	71	80
TC	DATE	CC	PART NUMBER	SUFF	REV	DESCRIPTION	QUA	U/M	SRC	E/F	CHG	S	M	MQ	UM	P/C	M	T/P	L	NEXT	ASSY
		A2	10343-02			HARNESS	010	E	C	0001							D	41	2	10362-01	5
		31	10101680			WIRE, #24 BLK	065	F	7	0001							D	41	3	10343-02	5
		31	10101672			WIRE, #24 BRN	045	F	7	0001							D	41	3	10343-02	5
		31	10101681			WIRE, #24 RED	065	F	7	0001							D	41	3	10343-02	5
		31	10101675			WIRE, #24 GRN	075	F	7	0001							D	41	3	10343-02	5
		31	10101676			WIRE, #24 BLU	055	F	7	0001							D	41	3	10343-02	5
		31	10101677			WIRE, #24 VIO	015	F	7	0001							D	41	3	10343-02	5
		31	10101679			WIRE, #24 WHT	015	F	7	0001							D	41	3	10343-02	5
		31	10101673			WIRE, #24 ORG	030	F	7	0001							D	41	3	10343-02	5
		31	10101674			WIRE, #24 YEL	030	F	7	0001							D	41	3	10343-02	5
		41	10100236			WRAP, TIE	500	E	7	0001							D	41	3	10343-02	5
		41	10101621			HOUS CLOS END	010	E	7	0001							D	41	3	10343-02	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A110357-02
USED ON TMF-CONTROL UNIT
NEXT ASSEMBLY A210362-01
TITLE PANEL REAR

PAGE 1 OF 1

1	2	7	9	17	18	19	40	43	44	45	63	64	70	71	80
TC	DATE	CC	PART NUMBER	SUFF	REV	DESCRIPTION	QUA	U/M	SRC	E/F	M	T/P	L	NEXT ASSY	C
			A1 10357-02			PANEL, REAR	010	E	C	0001	D	42	2	10362-01	5
			41 10100901			ALUM, BLK	500	C	7	0001	D	42	3	10101669	5
			72 10101571	D		PANEL, REAR	010	E	7	0001	D	42	3	10357-02	5
			72 10101669			LABEL, REAR	010	E	3	0001	D	42	3	10357-02	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A110353-01
USED ON TMF-CONTROL UNIT
NEXT ASSEMBLY A210342-01
TITLE PANEL, SIDE LEFT

PAGE 1 OF 1

1	2	7	9	17	18	19	40	43	44	45	63	64	70	71	80		
TC	DATE	CC	PART NUMBER	SUFF	REV	DESCRIPTION	QUA	U/M	SRC	E/F	REF	DESIGNATION	M	T/P	L	NEXT ASSY	C
			A1 10353-01			PANEL, SIDE LF	010	E	C	0001			1	10342-01	5		
			29 10101617			TRANSFORMER	010	E	7	0001			2	10353-01	5		
			41 10100326			CAST,CNR FR	010	E	7	0001			2	10353-01	5		
			41 10100327			CAST,CNR RE	010	E	7	0001			2	10353-01	5		
			41 10101062			EXTRU,SIDE	020	E	7	0001			2	10353-01	5		
			41 10101226			PLATE,STRU SID	010	E	7	0001			2	10101592	5		
			41 10101592		C	PANEL, SID LF	010	E	3	0001			2	10353-01	5		
			42 10007-04			SCREW, #6-1/2	030	E	7	0001			2	10353-01	5		
			42 10100332			NUT, CLIP	040	E	7	0001			2	10353-01	5		
			42 10100333			NUT, CLIP	040	E	7	0001			2	10353-01	5		
			42 10100334			NUT, HEX #8	040	E	7	0001			2	10353-01	5		
			42 10100335			SCREW, SPOTWELD	040	E	7	0001			2	10353-01	5		
			43 10100074			WASH, #6 FL	030	E	7	0001			2	10353-01	5		
			43 10100075			WASH, #6 SPL	030	E	7	0001			2	10353-01	5		
			72 10101579			BRKT,PCB MT	030	E	7	0001			2	10353-01	5		

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A110354-01
USED ON TMF-CONTROL UNIT
NEXT ASSEMBLY A210342-01
TITLE PANEL, SIDE RIGHT

PAGE 1 OF 1

1	2	7	9	17	18	19	40	43	44	45	63	64	70	71	80
TC	DATE	CC	PART NUMBER	SUFF	REV	DESCRIPTION	QUA	U/M	SRC	E/F	M	T/P	L	NEXT ASSY	C
		A1	10354-01			PANEL, SIDE RT	010	E	C	0001	D	60	1	10342-01	5
		41	10100326			CAST, CNR FR	010	E	7	0001	D	60	2	10354-01	5
		41	10100327			CAST, CNR RE	010	E	7	0001	D	60	2	10354-01	5
		41	10101062			EXTRU, SIDE	020	E	7	0001	D	60	2	10354-01	5
		41	10101226			PLATE, STRU SID	010	E	7	0001	D	60	2	10101591	5
		41	10101591		A	PANEL, SIDE	010	E	3	0001	D	60	2	10354-01	5
		42	10007-04			SCREW, #6-1/2	030	E	7	0001	D	60	2	10354-01	5
		42	10100332			NUT, CLIP	040	E	7	0001	D	60	2	10354-01	5
		42	10100333			NUT, CLIP	040	E	7	0001	D	60	2	10354-01	5
		42	10100334			NUT, HEX #8	040	E	7	0001	D	60	2	10354-01	5
		42	10100335			SCREW, SPOTWELD	040	E	7	0001	D	60	2	10354-01	5
		43	10100074			WASH, #6 FL	030	E	7	0001	D	60	2	10354-01	5
		43	10100075			WASH, #6 SPL	030	E	7	0001	D	60	2	10354-01	5
		72	10101579			BRKT, PCB MT	030	E	7	0001	D	60	2	10354-01	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A110273-04
USED ON TMF-CONTROL UNIT
NEXT ASSEMBLY A210342-01
TITLE ENCLOSURE

PAGE 1 OF 1

1	2	7	9	TC DATE	CC	PART NUMBER	17	18	19	DESCRIPTION	40	43	44	45	REF	DESIGNATION	63	64	70	71	80
											QUA	U/M	SRC	E/F			M	T/P	L	NEXT ASSY	C
										ENCLOSURE	010	E	7	0001			D	70	1	10342-01	5

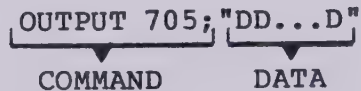
OPTION-02
IEEE-488 INSTRUMENT CONTROL

1.0 REMOTE PROGRAMMING

- 1.1 If the instrument is equipped with OPTION-02 the remote programming control is applied through the rear-panel IEEE-488 Bus interface connector. The addition of OPTION-02 does not affect the normal operation of the unit. Figure 1.1
- 1.2 With the addition of OPTION-02, two (2) MODES of operation are provided under Bus control. The programmable MODES of operation are "FULL BAND" and "START-STOP". When "FULL BAND" is selected the "F1" and "F2" controls are disconnected and 65535 points of resolution are provided. The "START-STOP" mode allows the user to pre-set "F1" and "F2" by adjusting the local front-panel controls. In the "START-STOP" mode the selectable frequency resolution is given by: $(\text{"F2"} - \text{"F1"})/65535$. With the 488-option there is a special command which allows connection of a filter capacitor across the output terminals for low-noise operation. (Caution: the tuning speed will be reduced with the capacitor in).

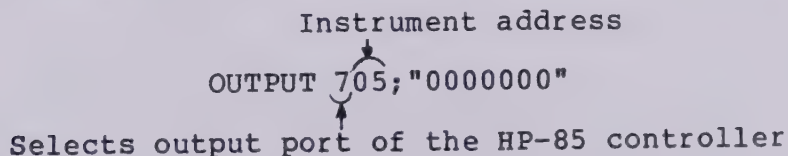
2.0 REMOTE PROGRAMMING INSTRUCTIONS

- 2.1 The 488 Bus uses two modes to communicate between instruments: Command Mode and Data Mode. To control any instrument on the Bus the Command must precede the Data.



During the Command Mode, the system controller addresses the instrument to be programmed. During the Data Mode, instructions and data are sent to the instrument.

- 2.2 The typical system controller command structure for the HP-85 is:



The above statement sends data to the instrument which has been preset to address "05".

* See paragraph 2.2.1

2.2.1 Bus Controller -- HP85 with following options

<u>QTY</u>	<u>ITEM</u>	<u>MODEL NO.</u>	<u>MFG.</u>
1	Controller	HP85A	HP
1	HPIB - Interface	82937A	HP
1	16K Memory Module	82903A	HP
1	ROM Drawer	82936A	HP
1	I/O ROM	00085-15003	HP
1	Advanced Prog. ROM	00085-15005	HP
1	Printer Plotter ROM	00085-15002	HP
1	IEEE-488 Cable (1 meter)		

Bus Controller with all necessary options is available as system
-- "IDEA 3001" from Idea Computer, 301 N. Santa Cruz Ave.,
Los Gatos, CA 95030, (408) 354-1210, contact Don Wolfe.

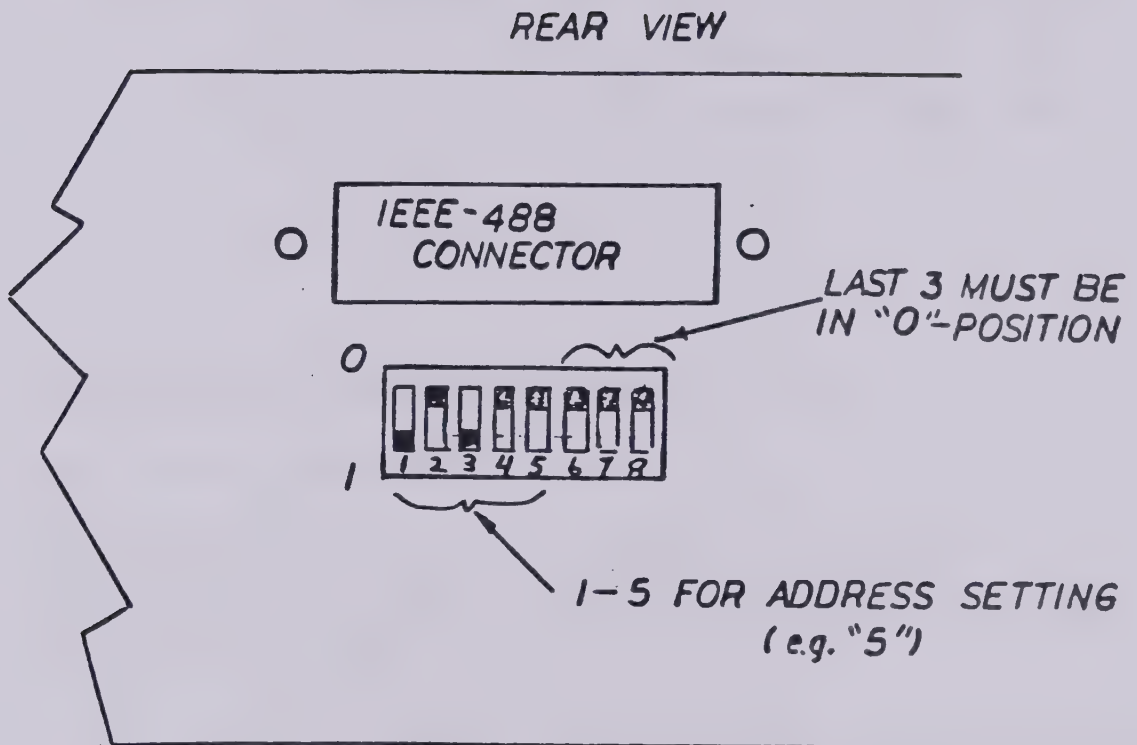


FIGURE 1.1 BUS CONNECTION

3.0 CODE SELECTION FOR HP-85 CONTROLLER

- 3.1 The OPTION-02 has 65536 steps or points of resolution which must be converted into meaningful code. The process by which IEEE-488 code is generated is graphically depicted in Diagram 3.1. Following is an explanation of the 3 sections of the diagram:

A. CONVERT DESIRED FREQUENCY TO DECIMAL FORMAT

PARAMETERS: F1 = minimum frequency (MHz)

F2 = maximum frequency (MHz)

F3 = desired frequency (MHz)

I4 = calculation variable

General Equation:

$$I4 = \text{INT} \left[\frac{65535 * (F3 - F1)}{(F2 - F1)} \right]$$

I4 is a decimal number which represents the code for the desired frequency.

B. DECIMAL TO HEX CONVERSION

Since the 488-system in the unit uses 16 Bit binary it is necessary to convert the decimal number into Hex-Code. The I/O ROM in the HP-85 allows base conversion functions but because of the string size restriction, the string has to be divided for conversion.

I5	=	INT (I4/256)	Integer representing first 2 characters of final 4 - character string.
I6	=	I4 - (I5 * 256)	Integer representing last 2 characters of final 4 - character string.
I5\$	=	DTH\$(I5)	Decimal to hex conversion
I5\$	=	I5\$[3,4]	Select substring (3rd and 4th character of string)
I6\$	=	DTH\$(I6)	Decimal to hex conversion
I6\$	=	I6\$[3,4]	Select substring (3rd and 4th character of string)
I7\$	=	I5\$ & I6\$	Assemble final hex string

C. CONVERT HEX-TUNING CODE TO TRANSMISSION CODE

The HEX-code can be converted to Transmission code with the "CONVERT" command of the HP-85 - I/O ROM. See Table 3.1 for the allowable Transmission Code (DATA).

Pl\$ = " A : B ; C < D = E > F ? "	Pl\$ represents the conversion table.
CONVERT out 7 pairs ; Pl\$	Convert statement acts on interface at select code 7 and uses Pl\$-conversion table.
OUTPUT 705 ; I7\$	Regular output statement to send data I7\$ to address 05
CONVERT out 7	Turns off the convert function.

- 3.2 After the completion of step "C" in the conversion process I7\$ contains the proper current information made up of 4 data characters "DDDD".

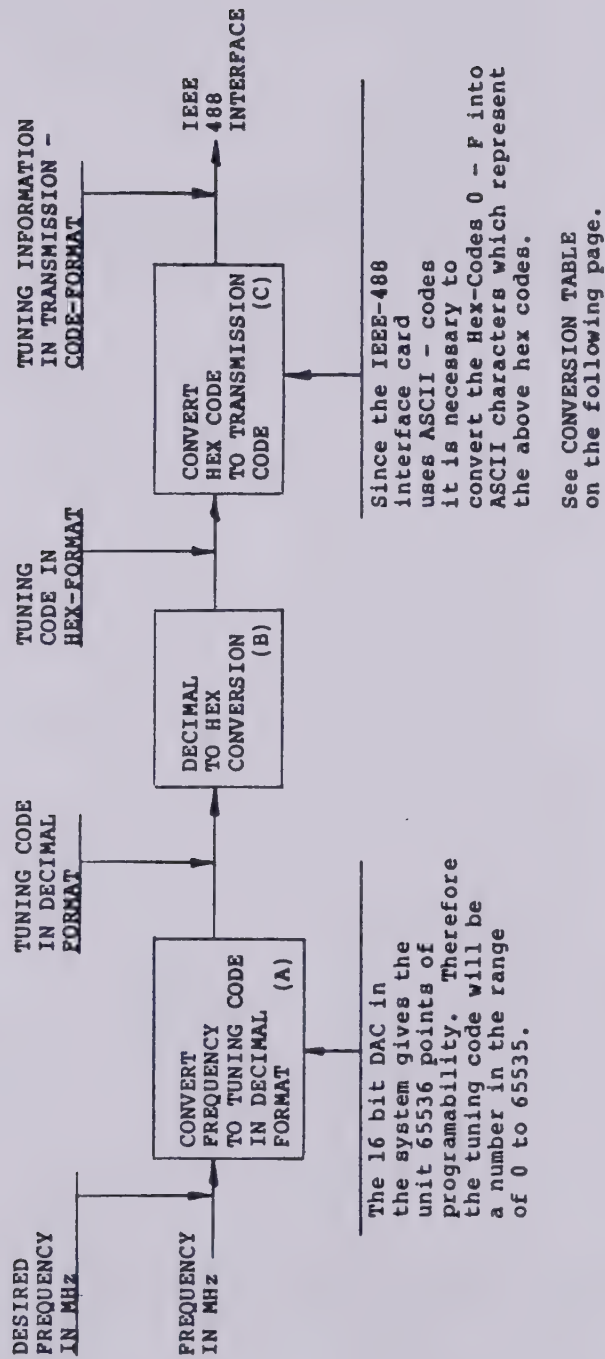


DIAGRAM 3.1 CODE SELECTION PROCESS

codes/tmf/V2

CONVERSION TABLE

HEX-CODE	TRANSMISSION CODE
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	:
B	;
C	<
D	=
E	>
F	?

TABLE 3.1 TRANSMISSION CODE

4.0 ALLOWABLE INSTRUMENT CODES (TMF-1800)

- 4.1 The code required on the IEEE-488 Bus is a 7 character string in the following form: "DDDDABC". If more than 7 characters are sent the instrument will ignore the remaining characters. (data reading is from left to right) The data code "DDDD" is explained in section 3.0.

"A" is the FULL BAND command:

<u>COMMAND</u>		<u>ALLOWED COMMAND CHARACTERS</u>
Full Band selected	=	1,3,5,7,9,;,=,?
Full Band not selected	=	0,2,4,6,8,:,<,>

"B" is the Fl-F1 mode command:

<u>COMMAND</u>		<u>ALLOWED COMMAND CHARACTERS</u>
Start-Stop Band selected	=	1,3,5,7,9,;,=,?
Start-Stop Band not selected	=	0,2,4,6,8,:,<,>

"C" is the Filter Capacitor command:

<u>COMMAND</u>		<u>ALLOWED COMMAND CHARACTERS</u>
Filter Capacitor IN	=	1,3,5,7,9,;,=,?
Filter Capacitor OUT	=	0,2,4,6,8,:,<,>

NOTE: To command the instrument with any controller the following switches must be set:

ON FRONT PANEL: MODE SWITCH to EXT

- 4.2 The following pages contain a sample program for controlling a TMF-1800 with the HP-85 controller. Program "TMF3" allows a selection of FULL MODE or START-STOP mode.
- 4.3 Following are two programming examples, one using FULL MODE and the other using START-STOP MODE.


```

10 ! ***INTEGRA MICROWAVE***
20 ! IEEE-488 PROGRAM FOR
    TMF 1800-TYPE 1 CONTRO
    L      UNIT
30 ! FOR 65535 POINTS
40 ! PROGRAM NAME TMF3
50 ! 11/30/83,WS, 13:00
60 ! WRITTEN FOR HP 85
70 CLEAR
80 DISP ""
90 DISP ""
100 DISP ""
110 DISP "    TMF-1800 PROGRAMMIN
    G"
120 DISP ""
130 DISP ""
140 DISP "DO YOU WANT SETUP INFO
    RMATION (Y/N) ?"
150 INPUT E$
160 CLEAR
170 IF E$="Y" THEN 920
180 DISP ""
190 DISP ""
200 DISP ""
210 DISP "SELECT BAND"
220 DISP "    FULL BAND (F)"
230 DISP "    START/STOP BAND
    (S)"
240 INPUT B$
250 IF B$="F" THEN 280
260 IF B$="S" THEN 440
270 GOTO 70
280 OUTPUT 705 ; "0000100"
290 CLEAR
300 DISP "ENTER FREQ. DISPLAYED
    (GHZ)"
310 INPUT F1
320 DISP ""
330 DISP ""
340 OUTPUT 705 ; "????100"
350 DISP "ENTER NEW FREQ. DISPLA
    YED (GHZ)"
360 INPUT F2
370 CLEAR
380 DISP "ENTER DESIRED FREQUENC
    Y (GHZ)?"
390 INPUT F3
400 DISP ""
410 DISP "CW FILTER ? (Y/N)"
420 INPUT F$
430 GOSUB 600
440 OUTPUT 705 ; "0000011"
450 CLEAR
460 DISP "DESIRED START FREQUENC
    Y (GHZ) ?"
470 INPUT F1
480 DISP ""
490 DISP "DESIRED STOP FREQUENCY
    (GHZ) ?"
500 INPUT F2

```

```

510 CLEAR
520 DISP "SET F1 CONTROL TO ";F1
    ;"GHZ"
530 GOSUB 1030
540 DISP ""
550 OUTPUT 705 ; "????011"
560 DISP "SET F2 CONTROL TO ";F2
    ;"GHZ"
570 GOSUB 1030
580 CLEAR
590 GOTO 380
600 IF F3<F1 THEN 860
610 IF F3>F2 THEN 890
620 X=IP(65535*((F3-F1)/(F2-F1))
    )
621 F5=INT(X/256)
622 F6=X-F5*256
623 F5$=DTH$(F5)
624 F5$=F5$[3,4]
625 F6$=DTH$(F6)
626 F6$=F6$[3,4]
627 F7$=F5$&F6$
720 IF F$="Y" THEN A$="1" ELSE A
    $="0"
730 IF F$="Y" THEN D$="IN" ELSE
    D$="OUT"
740 IF B$="F" THEN C$="10" ELSE
    C$="01"
750 Y$="0000"&C$&A$
751 P1$="A:B;C<D>E>F?"
752 CONVERT OUT 7 PAIRS ; P1$
760 OUTPUT 705 ; Y$
770 WAIT 50
780 X$=F7$&C$&A$
790 OUTPUT 705 ; X$
792 CONVERT OUT 7
800 DISP "FILTER IS TUNED TO";F3
    ;"GHZ"
810 DISP "CW-FILTER IS ";D$
820 DISP ""
830 DISP "*****"
840 DISP ""
850 GOTO 380
860 DISP "SELECTED FREQ. BELOW T
    HE START FREQ."
870 GOSUB 1030
880 GOTO 370
890 DISP "SELECTED FREQ. ABOVE T
    HE START FREQ."
900 GOSUB 1030
910 GOTO 370
920 DISP ""
930 DISP ""
940 DISP "SET THE IEEE-488 ADDRE
    SS SWITCH (ON REAR PANEL OF
    THE TMF 1800)"
950 DISP "REQUIRED CODE IS BINAR
    Y 5 (CODE 10100000)"
960 DISP ""

```



```
970 DISP "TURN OFF POWER TO TMF  
1800, THEN TURN POWER BACK ON  
"  
980 DISP "(ADDRESS IS LOADED AT  
POWER TURN ON) "  
990 DISP ""  
1000 GOSUB 1030  
1010 CLEAR  
1020 GOTO 180  
1030 DISP "PRESS CONT WHEN READY  
"  
1040 PAUSE  
1050 RETURN
```


4.3 (continued) DATA CODE EXAMPLES

A. FULL BAND

Let us assume the following conditions:

- 1) FULL BAND
- 2) 7.00 GHz desired frequency
- 3) Filter capacitor IN

With the above information carry out the code conversions described in section 3.0 parts A, B, and C.
First convert the desired frequency in to a decimal Format.

F1 = Min. frequency (MHz)	= 2000
F2 = Max. frequency (MHz)	= 18500
F3 = Desired frequency (MHz)	= 7000

After performing the algebra: I4 = 19859
Next make the decimal to HEX conversion.

I5	= 77
I6	= 147
I5\$	= 004C
I6\$	= 0093

The HEX code for 7.00 GHz in the FULL BAND is: I7\$ = 4C93

Now convert the HEX code to Transmission Code by direct substitution.

I7\$ = "4=93"

Last, add the Mode and capacitor information. Then the final command with data is:

	Frequency		Filter
	↓	↓	↓
OUTPUT 705;	"4=96101"		
	↑	↑	↑
	Full Band	START-STOP Mode	

Before sending the output statement set the TMF-1800 up accordingly:

- * Connect unit to HP-85
- * Set the ADDRESS
- * Turn on POWER
- * Send the COMMAND

NOTE: The FULL MODE operation disengages all front-panel controls. When in the FULL MODE the EXT mode select switch need not be set unless the SWEEP-OUT connection on the rear-panel is being used.

The TMF-1800 should respond with a meter reading of 7.000 GHz.

B. START-STOP MODE

Select the conditions for operation:

- 1) Start frequency 2.00 GHz
(set = 2.00 GHz, front panel control)
- 2) Stop frequency 12.00 GHz
(set F2 = 12.00 GHz, front panel control)
- 3) Desired frequency 7.00 GHz
- 4) No filter capacitor

Again, refer to section 3.0 parts A, B, and C to obtain the proper frequency information data.

After performing the algebra: I4 = 62768

Carry out the decimal to HEX Conversion: I7\$ = "2048"

Convert the HEX to sendable 488 code: I7\$ = "2048"

Add the filter and MODE information and construct the proper statement.

OUTPUT 705; "2048010"

For the START-STOP mode of operation set the TMF-1800 up as follows:

- * Connect the controller to the instrument
- * Set the ADDRESS
- * Select EXT MODE
- * Turn POWER ON
- * Set START frequency
 - a) OUTPUT 705; "0000000"
 - b) adjust F1 control to 2.00 GHz
- * Set STOP frequency
 - a) OUTPUT 705; "????000"
 - b) adjust F2 control to 12.00 GHz
- * Send the COMMAND

Again, the TMF-1800 should respond with a meter reading of 7.00 GHz.

5.0 LISTEN ADDRESS CODES

- 5.1 In a 488 system, the TMF-1800 Option-02 functions as a Listener. A listener is a device capable only of receiving data or commands from other instruments. The TMF-1800 is enabled as a listener when the controller transmits the correct listen address code. The TMF-1800 interface ignores all commands or addresses relating to talkers or controllers.
- 5.2 The seven-bit codes served for listen addresses and the corresponding ASCII character are listed in Figure 5-1. (A total of 31 addresses are available) Bits one through five of the data (DIO) lines are set either high or low to select the address. The address code is set with five address switches (Figure 1.1) on the rear panel. An open contact (off position) indicates a true state.
- 5.3 The nominal TMF-1800 listen address is ASCII Character "05". The address may be changed by the system designer since the TMF-1800 does not require any particular address. When changing addresses, be sure the new address does not conflict with those of other instruments using the 488 Bus (Refer to Figure 1.1).

After changing the address, turn unit OFF and ON again to properly initialize the 488-card.

Address Switch Numbers					Address Characters		Octal Value	Decimal Value
5	4	3	2	1	Talk	Listen		
0	0	0	0	0	@	SP	00	00
0	0	0	0	1	A	!	01	01
0	0	0	1	0	B	"	02	02
0	0	0	1	1	C	#	03	03
0	0	1	0	0	D	\$	04	04
0	0	1	0	1	E	%	05	05
0	0	1	1	0	F	&	06	06
0	0	1	1	1	G	'	07	07
0	1	0	0	0	H	(	10	08
0	1	0	0	1	I	)	11	09
0	1	0	1	0	J	*	12	10
0	1	0	1	1	K	+	13	11
0	1	1	0	0	L	,	14	12
0	1	1	0	1	M	-	15	13
0	1	1	1	0	N	.	16	14
0	1	1	1	1	O	/	17	15
1	0	0	0	0	P	0	20	16
1	0	0	0	1	Q	1	21	17
1	0	0	1	0	R	2	22	18
1	0	0	1	1	S	3	23	19
1	0	1	0	0	T	4	24	20
1	0	1	0	1	U	5	25	21
1	0	1	1	0	V	6	26	22
1	0	1	1	1	W	7	27	23
1	1	0	0	0	X	8	30	24
1	1	0	0	1	Y	9	31	25
1	1	0	1	0	Z	:	32	26
1	1	0	1	1	[	;	33	27
1	1	1	0	0	\	<	34	28
1	1	1	0	1	]	=	35	29
1	1	1	1	0	^	}	36	30
1	1	1	1	1	_	?	37	31

FIGURE 5.1 SWITCH CODES

6.0 OPTION-02 CIRCUIT

6.1 488 INTERFACE BOARD

The 488 Interface Board is controlled by way of the 488 Interface Bus. The data is received and transmitted by IC19 and IC20. Led (CR7) indicates the power-up procedure is complete. IC8 is the central processor which sends instructions to IC9 and IC10. IC9 controls IC1 which is a 16 bit digital to analog converter. IC1 provides the 0 to +10.000V output analog signal. IC10 controls relays K1 to K4. K1 & K2 engages the filter capacitor and K3 is used to select START-STOP the mode of operation, K4 selects Full Band mode of operation.

The following pages contain:

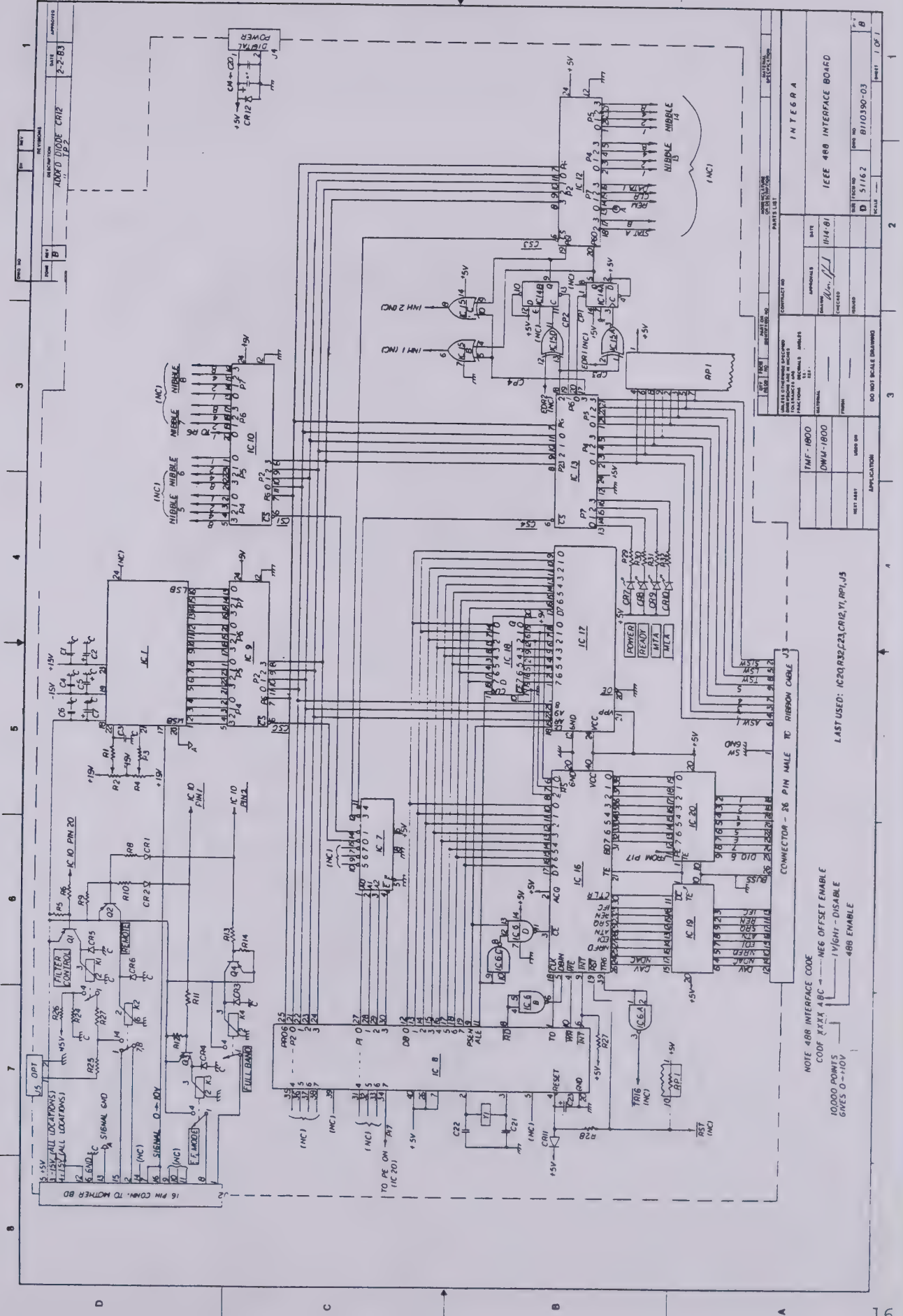
- a) schematic (B110390-03)
- b) comp-placement (B210390-03)
- c) connector/switch Brd B210389-01
- d) 488 Paddle Brd B110309-01
- e) part list

6.2 VISUAL INSPECTION

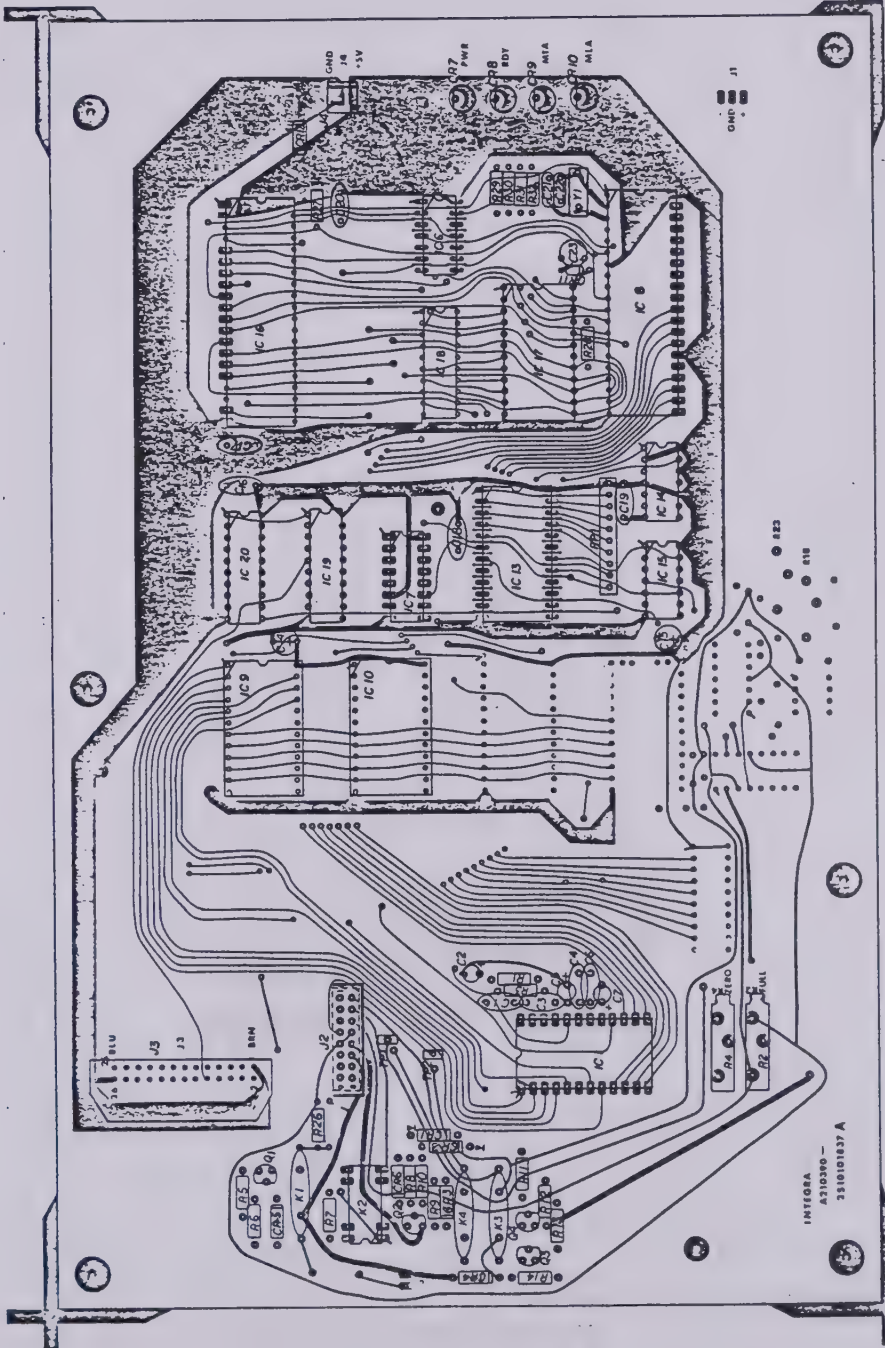
If the 488 does not seem to function:

- 1) check to see that the address is correct
- 2) check to see if CR7 on the 488 board is energized
- 3) send a command and check to see that CR8 is energized

NOTE: If CR7 and CR8 fail, call the factory Representative.



DATE	REV	BY	APP
10/1/83	1	W	W
REVISIONS		DATE	BY
1. ADDED DOWEL CRIP & B2		2-2-83	W



DATE		REV	BY	APP
10/1/83		1	W	W
REVISIONS		DATE	BY	APP
1. ADDED DOWEL CRIP & B2		2-2-83	W	W

DATE		REV	BY	APP
10/1/83		1	W	W
REVISIONS		DATE	BY	APP
1. ADDED DOWEL CRIP & B2		2-2-83	W	W

DATE		REV	BY	APP
10/1/83		1	W	W
REVISIONS		DATE	BY	APP
1. ADDED DOWEL CRIP & B2		2-2-83	W	W

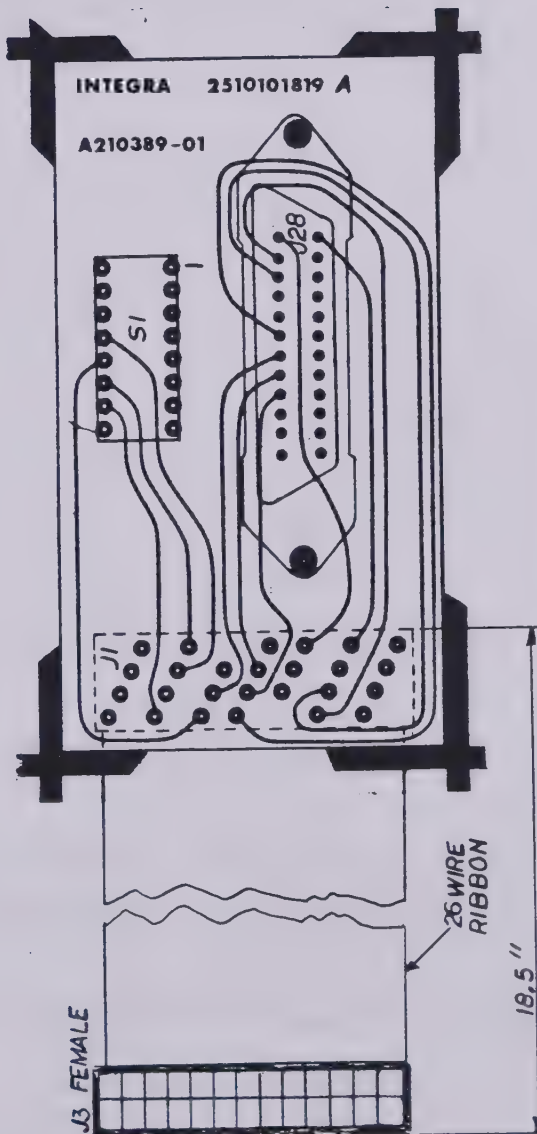
DATE		REV	BY	APP
10/1/83		1	W	W
REVISIONS		DATE	BY	APP
1. ADDED DOWEL CRIP & B2		2-2-83	W	W

LAST USED: IC20, R32, C23, CR12, V1, RPI, J5

DWG. NO. SH REV

REVISIONS

REV	DESCRIPTION	DATE	APPROVED



QTY REQD		FSCM NO.	PART OR IDENTIFYING NO.	NOMINATURE OR DESCRIPTION		MATERIAL SPECIFICATION
PARTS LIST						
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES FRACTIONS DECIMALS ANGLES		CONTRACT NO.		INTEGRA		
± .01 ± .005 ± .002 ± .001		APPROVALS		CONNECTOR/SWITCH BOARD		
MATERIAL		DRAWN RH		DATE 7-9-81		
FINISH		CHECKED <i>Wm M. A.</i>		DATE 7-9-81		
DO NOT SCALE DRAWING		ISSUED		SIZE FSCM NO. DWG. NO. REV		
APPLICATION		SCALE 2 ~ 1		B 51162 B210389-01 A		
TMF-1800		SHEET		2 ~ 1		
DWIM-1800						
TMF-1800H						
TMF-1800K						

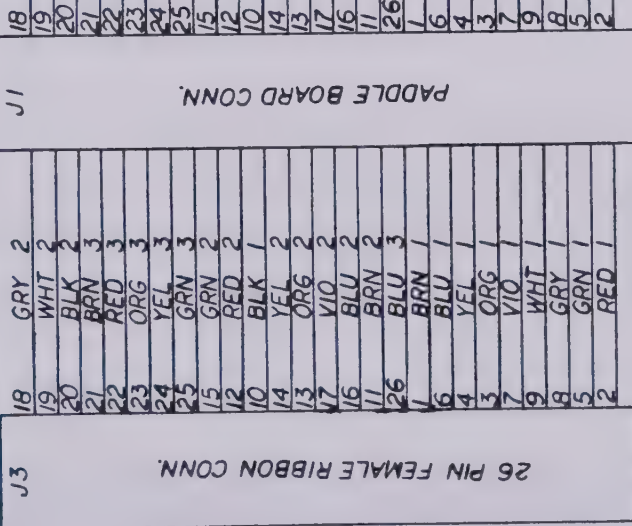
DWG. NO. SN REV.

REVISIONS

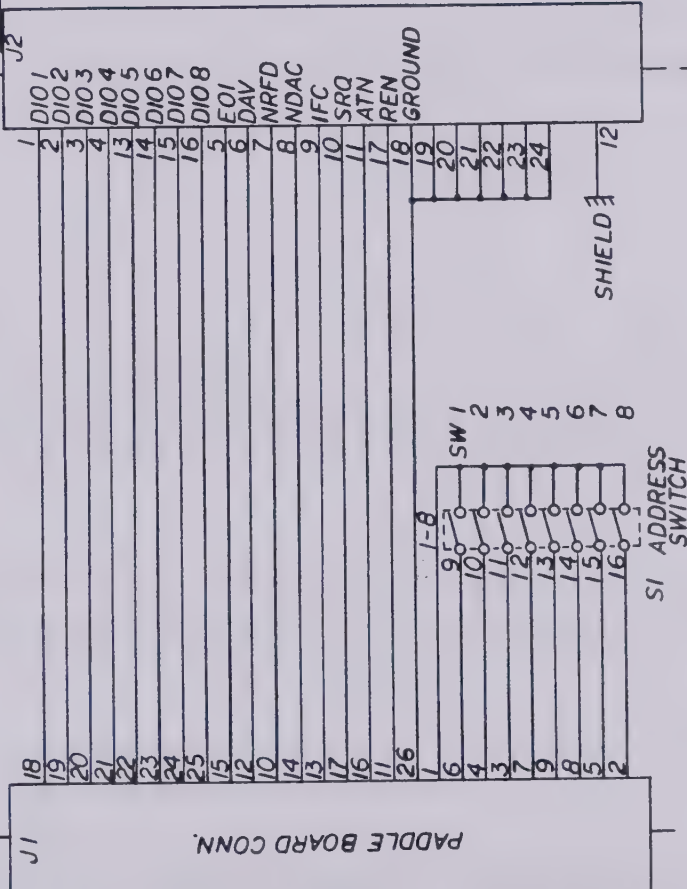
DESCRIPTION DATE APPROVED

REV.

RIBBON CABLE



CONNECTOR / SWITCH BOARD



QTY REQD		FSCM NO.		PART OR IDENTIFYING NO.		NOMENCLATURE OR DESCRIPTION		MATERIAL SPECIFICATION	
PARTS LIST									
CONTRACT NO.									
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:									
FRACTIONS		DECIMALS		ANGLES		DATE		APPROVALS	
±		±		±		7-27-88		DRAWN RLH	
MATERIAL		FINISH		DO NOT SCALE DRAWING		CHECKED		ISSUED	
ALL INST. WITH 488		NEXT ASSY		USED ON		SCALE		SHEET	
APPLICATION		SIZE		FSCM NO.		DWG. NO.		REV.	
		B		51162		B110389-01			

1	2	7	9	17	18	19	DESCRIPTION	40	43	44	45	63	64	70	71	80
TC	DATE	CC	PART NUMBER	SUFF	REV			QUA	U/M	SRC	E/F	M	T/P	L	NEXT ASSY	C
A2	10390-03		IEEE 488 INT BD					010	E	C	0001	00	00	0	STOCK	5
13	10100088		C CER 0.01 UF					090	E	7	0001	00	00	1	10390-03	5
13	10100968		C MICA 24 PF					020	E	7	0001	00	00	1	10390-03	5
13	10101900		C ELEC 10 UF					040	E	7	0001	00	00	1	10390-03	5
13	10101936		C ELEC 4.7 UF					020	E	7	0001	00	00	1	10390-03	5
14	10101958		CRYSTAL, 11.0596MHZ					010	E	7	0001	00	00	1	10390-03	5
15	10100019		DIODE					010	E	7	0001	00	00	1	10390-03	5
15	10101633		DIODE, 1N4004					070	E	7	0001	00	00	1	10390-03	5
17	10100382		LED, RED					040	E	7	0001	00	00	1	10390-03	5
19	10101109		IC, DAC-71-CCD-V					010	E	7	0001	00	00	1	10390-03	5
19	10101891		IC, SN74LS00N					010	E	7	0001	00	00	1	10390-03	5
19	10101933		IC, 74LS138					010	E	7	0001	00	00	1	10390-03	5
19	10101934		IC, 75161					010	E	7	0001	00	00	1	10390-03	5
19	10101935		IC, 75160					010	E	7	0001	00	00	1	10390-03	5
19	10101939		IC, 8039-L					010	E	7	0001	00	00	1	10390-03	5
19	10101940		IC, 74LS373					010	E	7	0001	00	00	1	10390-03	5
19	10101941		IC, 2716					010	E	7	0001	00	00	1	10435-01	5
19	10101942		IC, TMS9914NL					010	E	7	0001	00	00	1	10390-03	5
19	10101943		IC, 74LS86					010	E	7	0001	00	00	1	10390-03	5
19	10101944		IC, 74LS74					010	E	7	0001	00	00	1	10390-03	5
19	10101945		IC, 8243					030	E	7	0001	00	00	1	10390-03	5
19	10435-01		IC, PROM 8K					010	E	3	0001	00	00	1	10390-03	5
25	10101837		A PCB					010	E	7	0001	00	00	1	10390-03	5
26	10100785		RELAY					030	E	7	0001	00	00	1	10390-03	5
26	10101629		RELAY					010	E	7	0001	00	00	1	10390-03	5
27	10100110		R CARB 10K					090	E	7	0001	00	00	1	10390-03	5
27	10100225		R CARB 33K					010	E	7	0001	00	00	1	10390-03	5
27	10100303		R CARB 510K					010	E	7	0001	00	00	1	10390-03	5
27	10100304		R CARB 1K					010	E	7	0001	00	00	1	10390-03	5
27	10100411		R CARB 3.3M					010	E	7	0001	00	00	1	10390-03	5
27	10100426		R CARB 1					010	E	7	0001	00	00	1	10390-03	5
27	10101121		R CARB 68					010	E	7	0001	00	00	1	10390-03	5
27	10101937		R CARB 160					040	E	7	0001	00	00	1	10390-03	5
27	10101938		R SIP 33K					010	E	7	0001	00	00	1	10390-03	5
28	10100321		R VAR 50K					02 >	E	7	0001	00	00	1	10390-03	5
30	10100095		TRANS, 2N4126					040	E	7	0001	00	00	1	10390-03	5
41	10100084		SOCKET, 14 PIN					030	E	7	0001	00	00	1	10390-03	5
41	10100085		SOCKET, 40 PIN					020	E	7	0001	00	00	1	10390-03	5
41	10100128		SOCKET, 16 PIN					010	E	7	0001	00	00	1	10390-03	5
41	10100131		SOCKET, 24 PIN					050	E	7	0001	00	00	1	10390-03	5

INTEGRA INC
ENGINEERING PARTS LIST

ASSEMBLY # A210390-03
USED ON TMF-DWM

NEXT ASSEMBLY STOCK
TITLE

PAGE 2 OF 2

IEEE 488 INTERFACE BOARD

1	2	7	9	17	18	19	40	43	44	45	63	64	70	71	80				
TC	DATE	CC	PART	NUMBER	SUFF	REV	DESCRIPTION	QUA	U/M	SRC	E/F	REF	DESIGNATION	M	T/P	L	NEXT	ASSY	C
			41	10100818			TERMINAL	010	E	7	0001	TP 1			00	1	10390-03		5
			41	10101122			SOCKET, 20 PIN	030	E	7	0001				00	1	10390-03		5
			41	10101624			CONN, 2 PIN	010	E	7	0001	J 4			00	1	10390-03		5
			41	10101625			CONN, 16 PIN	010	E	7	0001	J 2			00	1	10390-03		5
			41	10101815			CONN, 26 PIN	010	E	7	0001	J 3			00	1	10390-03		5

MP MASTER



MA32405